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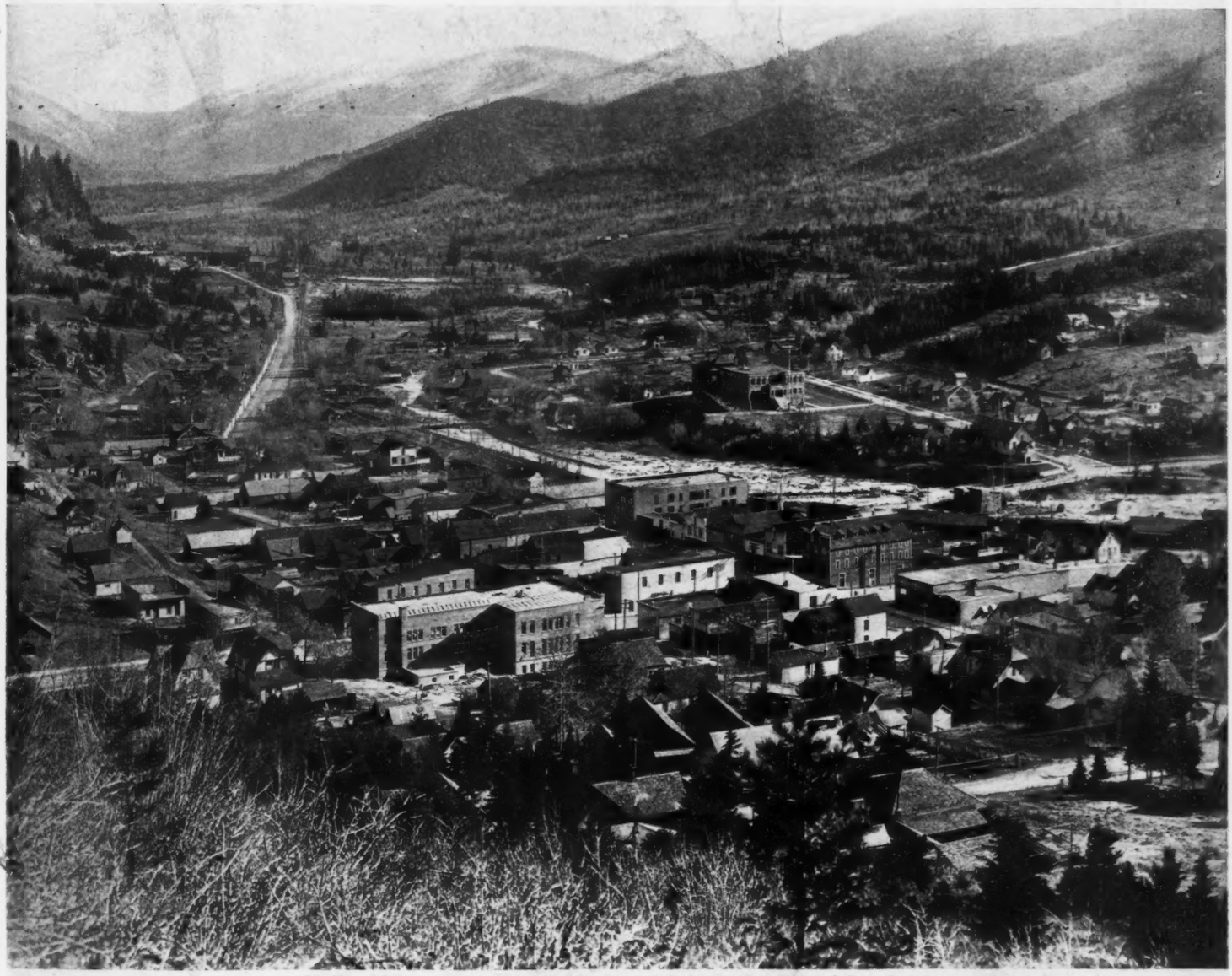


Mullan, Idaho, a Mining Town in the Coeur d'Alene Lead, Silver and Zinc District

April 30, 1921

Columbia School of Mines Idea

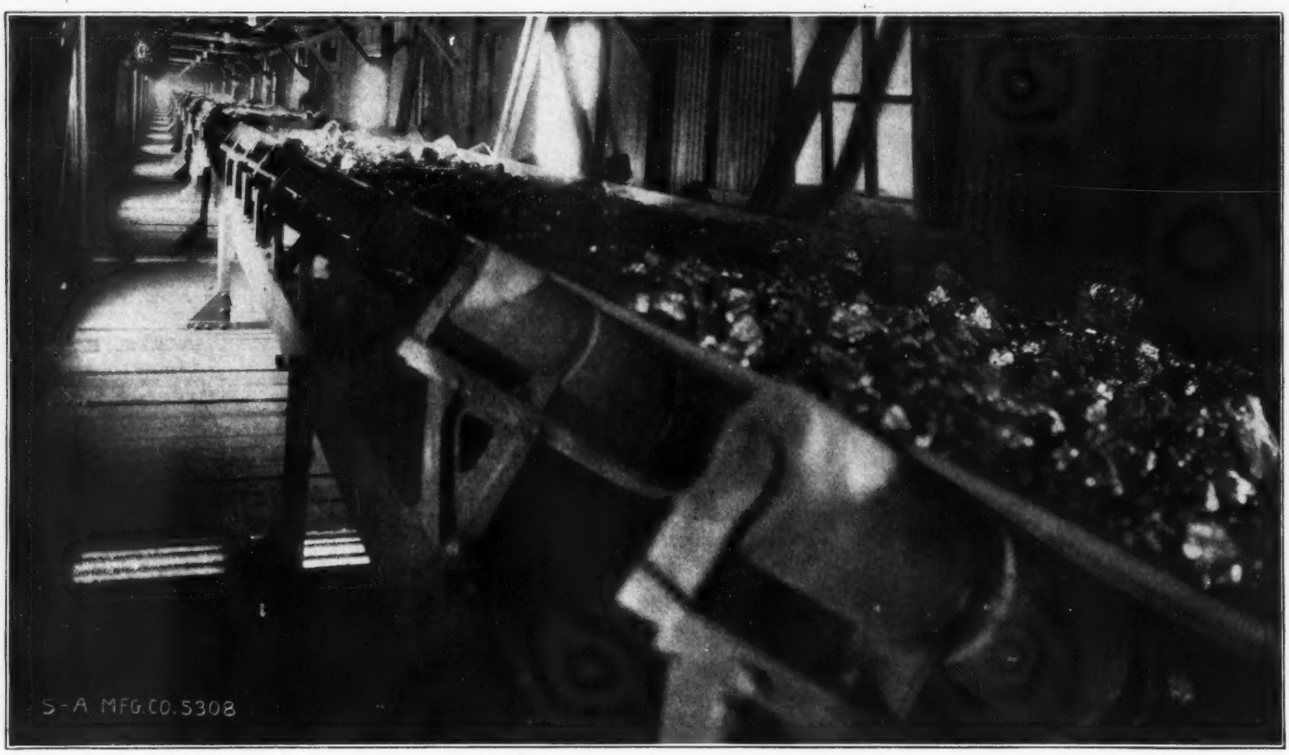
By George J. Young

The Mining of Chrome Ore in Turkey

By Rufus W. Lane

Dust Control and Ventilation in Metal Mines

By D. Harrington



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Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

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Special Consulting Editors

Volume 111 **New York, April 30, 1921** *Number* 18

Education of Mining Engineers

IT WOULD BE DIFFICULT to estimate in specific terms the part played by the college and university graduates in the mining industry. Neverthless, when we examine the progress made in technical lines we find the progressive, well-trained graduate a potent factor. In operating positions, in the laboratory, in the field, and in the professional office he is fulfilling a useful purpose, and his numbers are growing. Like the proverbial cork in the tar barrel, he is getting to the top in spite of the viscosity of the medium selected. When we say this, it is without disparagement to the man who has struggled up from the ranks and who by individual study, experience, and hard work has won recognition. He also is an essential part of the industry, and gets to the top as well.

The graduate in mining does not always obtain prominence and remunerative employment easily. He may enter the industry via the muck-stick route, or he may have to serve in many subordinate positions before he has a chance to win his spurs. Employers are sometimes callous toward him and unsympathetic to the man who proposes to advance by a route different from their own. Many employers overlook the fact that the institutions of technical learning gather the greater proportion of alert, capable men, and that the product from these schools represents a wealth of good material which, if sympathetically handled and properly developed, will measurably enhance the success of their undertakings. More astute employers realize the advantage of securing men from the group that has gone through the process of selection operative in the well-organized institution and are willing to recognize the value of the individual who has a basic knowledge of things acquired by systematic and well-directed study.

There is discernible progress in institutions of technical learning toward meeting the requirements of modern life. Sporadic criticism has been flung at them without much discrimination, and although it lacks specific value, it has had the effect of keeping faculties stirred up and alive to the need for improvement. In another part of this issue we present a brief sketch of changes that have taken place during the last few years in the School of Mines of Columbia University. This remarkable school has a splendid record. From "Daddy" Kemp to Raymond it has consistently provided a strong and well-balanced faculty. Now it has established a new plane, a new ideal. Better graduates in a broad sense are to be turned out. Quantity production has been displaced by quality production. In readjusting its courses and organizing a high-class personnel upon its faculty, Columbia University presents to the able student the opportunity of association with other able students under a consistent plan for well-directed study. If the student co-operates in the same spirit, the graduate product will more nearly approach the ideal, a man thoroughly trained in fundamentals and with an active, open mind.

Some time ago, Professor Robert Peele presented an able paper on the subject of "The Education of the Mining Engineer" to the Mining and Metallurgical Society of America. This represented the result of close study and wide experience with mining educational problems. One of the significant facts brought out by Professor Peele was the excessive number of mining schools in the United States. The total is forty-three, and this is out of all proportion to the needs of the industry. Professor Peele said, "There is great waste of time and energy in such a reduplication of schools. Since there is no common standard of attainment, the degrees conferred at different schools mean very different things. Often they imply no definite amount or kind of training. The situation is made even worse by the inevitable competition for students, which lowers the requirements for entrance, tends to laxity of discipline, and injures the quality of student work."

The answer to this condition, in the absence of systematic effort looking to its control, appears to us to have been given by Columbia and other institutions of like standing. By the maintenance of standards, these schools will turn out a responsible product, acceptable both to employers and to the profession.

An Investigation of the Copper Shutdown

A PRESS NOTICE in the New York daily papers reports a possible Government investigation of the leading copper companies for the purpose of ascertaining whether the recent shutdown was brought about by common agreement, in which event the Attorney General might find cause for acting under the Sherman Law. It is exceedingly doubtful whether such investigation will disclose any infraction of the law, as is evident from the fact that the shutdown is not nearly as complete as is commonly supposed—barely more than 50 per cent of present production. Undoubtedly the Department of Justice knows or will find that the four great porphyry mines acted under common agreement, which is not so strange, considering their joint control and interlocking directorates. Furthermore, the department will no doubt discover that large subsidiary companies of important producers were actuated by the same governing motives. For example, Inspiration followed Anaconda, a parent organization. But many important copper companies, in fact most of these out of the ring of large producing interests—Hayden-Jackling group, Rockefeller-Ryan group, and others—have steered an independent course. Several of them—Miami is an instance—have definitely decided to continue operations and are enabled to do so by their advantageous financial position.

The investigation, to be complete, will have to consider costs of production; and, even granted that the suspending companies are able to produce copper at present prices when running to capacity—a very doubtful question—can the investigators suggest a means of persuading an unreceptive market to absorb the additional copper that would be produced? Or a means of reducing the tremendous surplus stocks in the country?

The action of the copper producers was taken to conserve their industrial existence and not in restraint of trade. Copper can be obtained at prices low enough to satisfy any rationally minded consumer—lower than for years. We would prefer to find out why copper tubing recently cost a silver-mine operator at the rate of one dollar per pound and sheet copper 54c. per pound rather than if the copper shutdown possibly violates an existing statute.

It would have been to the advantage of the industry had a greater number of producers participated in the shutdown; and should present conditions continue, it would not be surprising to see other companies gradually added to the ranks of the closed properties.

How little has actually been accomplished by the Government in aiding industry since the armistice! Two and one-half years after hostilities the greatest political and economic problems that have ever faced a nation remain unsolved. Despite legislative vehicles commendably enacted for the convenience of foreign trade, we find no real progress in holding the export commerce gained during the war. The crudest sort of tariff legislation has been proposed, and Congress is still at sea over protection or free trade for American industry. The political difficulties of a satisfactory peace with Germany still await solution; and meanwhile—industrial depression continues. Yet, regardless of the stupendous problems confronting the country, the suggestion is brought forth that taxpayers' money be used to investigate one of the results rather than the cause of present economic and social disturbances.

How much better it would be to direct attention to intelligent constructive aid for the copper producer, wheat grower, and the manifold agricultural and industrial organizations that are affected by present economic conditions!

Timing the Gears

WITH CHARACTERISTIC CLEARNESS Herbert Hoover, in an address delivered before the Philadelphia Engineers Club, has pointed out the need of reorganization of the Government. The interlocking functions of bureaus, departments, and committees—wheels within wheels—with which the country's administration is at present burdened, only serve as impediments to national enlargement, and not until the business of the nation is freed from complicated entanglements, the slack taken up, and the overlap removed can we hope to attain the proper degree of efficiency in Government organization.

As a people, we take a justifiable pride in our business institutions. They are like well-balanced machinery—exact and carefully fashioned—and move with precision. Each function that they perform is deliberately arranged; and each part so designed that there is no interference from the others. Were this not so our supremacy as a nation of manufacturers would not exist; we would become second-raters, or fall completely out of the running. True enough, with advancement has come additional detail, but each new unit or function has been carefully separated, and, although related to the main body or machine, there has been the underlying principle of effective concentration.

Mr. Hoover points out that, "In a department [referring to the Department of Commerce] we do not want to either engage in business or to regulate business," which is perfectly true. Nevertheless, the operation of such a department must be conducted along business lines; its functions must be entirely within itself and its duties so defined that the services demanded by industry can be furnished to the fullest extent, and at the most reasonable price, if it is to fulfill—more than in name only—the purposes of a Department of Commerce.

It would seem that the time is particularly auspicious to take cognizance of this condition and cut the Gordian knot of conflicting and overlapping Government activities, which, if permitted to remain, will only lead to endless confusion. An earnest effort is being made, we believe, to disentangle the mess, to get down to fundamentals, and definitely to place the boundaries of each department. The evidence already gathered shows inefficient working of different departments in the past—in particular the Department of Commerce—and is sufficient to convince that there is a need for change and that a change should be made. Already Congress has put the problem up to a Congressional joint committee. But more than this is needed; namely, the "full insistent support of the public."

The Tom Reed-United Eastern Apex Litigation

EXTRACTS FROM THE INTERESTING DECISION of Judge Bollinger, of the Superior Court of Arizona, recently handed down in the Tom Reed-United Eastern issue, are published on page 747 of this number. The Tom Reed mine claimed ownership of the vein in the United Eastern. The Tom Reed was the original location, and the Tom Reed vein was followed down till it was cut off by a fault. We believe it is a matter of history, although it is not recorded in the decision, that the Tom Reed searched for the vein on the other side of the fault, but could not locate it; and that employees of the Tom Reed formed the theory that the vein had been thrown out of the company's ground, and located the United Eastern property, on that geological theory, which subsequently proved to be correct, the downward extension of the vein being found, terminating, of course, upward against the fault. This upward termination the United Eastern claimed as an apex, and the court so ruled, although the fact that the vein is identical on both sides of the fault was proved to its satisfaction.

There seem to be two essential elements in the judge's decision: first that the amount of faulting as measured on a vertical plane at right angles to the vein (over four hundred feet) must be regarded as breaking the continuity of the vein, although not disturbing its original identity; second, that the horizontal element of faulting was much greater than the vertical, and probably amounted to several thousand feet, so that the ore in the United Eastern is not that broken off in the Tom Reed. Thus there appears in apex litigation a recognition of the legal aspect of the horizontal movement in faults, which has only been fully realized as a geological phenomenon for a few decades or so.

Looking at the matter from a casual and extra-legal

point of view, there are evidently two sides to the question, but in general we have to grant the common sense arguments of the judge, which are grounded largely on his perception of geological facts. Yet he has, it is plainly evident from the decision, small thanks for the geologist:

"There were a number of eminent geologists and mining engineers who testified in this case, many of them not only with national but international reputations. A few practical miners also testified and furnished the court with very valuable information, *because the problems involved in this case are largely practical ones.*"[1]

Further on he observes: "This case must be decided from a practical viewpoint as the miners find conditions in the ground today, or it must be decided upon the theories and testimony of geologists, in accordance with conditions as they existed many thousands or millions of years ago. If the decision be based upon the theory and testimony of the geologists, it seems to me that no mining location in the Oatman district could be secure or valid."

The judge accordingly decided with the practical men, and against the geologists. The "geologists," witnesses for the Tom Reed, we note, include Andrew C. Lawson, Albert Burch, Walter H. Wiley, and Oscar H. Hershey; and the "practical men," witnesses for the United Eastern, include Horace V. Winchell, William H. Emmons, John A. Burgess, and Fred Searls. The court has accordingly ruled that the latter are not geologists. This is a part of the decision which we would question, however. A legal precedent seems to have been established, which we have noted in previous cases, for the judge to characterize the witnesses for the side that he decides against "geologists," and those for whom he decides "practical men." If the judge would make the definition more concise, it would doubtless be "A geologist in the apex sense is a witness for that litigating party which is in the wrong." As many of our court geologists regard a legal decision as clinching geological points, they would doubtless feel that they could loyally accept this also.

Another legal definition in the decision will also be entered in their notebooks, "A fault is merely a vein which is not mineralized." This definition will doubtless be cited by judges and apex geologists yet unborn. The legal corollaries of this, we suppose, would be thus expressed: "A vein is merely a vein which is mineralized," and also, "A vein is merely a fault which is mineralized."

The judge, whose horse sense, we repeat, pierces the fogs of law and geology, describes with interest geological processes as he learned them during the trial, but there is little trace of collusion with a geologist in his verbiage. Recognizing the interest of the wonders of nature, he is inclined, when it comes to dollars and cents, to get down to hard facts.

"We are reliably informed by geologists," he observes, "that this northwest section of Arizona, including the San Francisco mining district and Oatman, *experienced at some time in the past a great upheaval and sank about six thousand feet. With this in mind,* the court is compelled to view this case from a practical standpoint and adopt the views of the practical miners, and view the conditions as they are today and as they were when the rights of all parties herein were acquired."

[1]The italics here and later on are ours.—EDITOR.

Minor Trouble With Pittman Act Machinery

THE REPURCHASES OF SILVER under the Pittman Act have in general been made smoothly and satisfactorily. The major difficulties which were first encountered in the administration of the repurchase provisions were easily ironed out through exemplary co-operation between the domestic silver producer and the Government. The form of affidavits to be used, the satisfaction of the Government as to the authentic domestic origin of the silver, and other matters which at one time threatened to disturb the machinery of the Pittman Act were cleared with commendable celerity. Now, however, we find that a detail has been apparently overlooked which, according to an article on page 746 of this issue, is a hardship on a smaller silver producer.

It appears that although the full dollar per ounce is being paid at the mints of the country for domestic silver purchased by the Government, the minor assay offices are permitted to pay only the New York price for foreign silver, which is now quoted but little over half the dollar rate. The minor assay offices are of course in the habit of receiving gold bullion from local mining companies, and, as the article points out, the silver in the bullion is settled for only on the foreign silver price basis. Manifestly, this is not within the spirit of the Pittman Act, which was put upon the statutes not for the especial benefit of the large and more prosperous silver producer but for all domestic silver producers alike. This undesirable feature of administration can and should be easily eliminated, thereby making the act equitable to all classes of silver miners and removing what might be termed a little "knock" in the operating cylinders of the Pittman Act.

International Adjustments

GOLD IS POURING into this country from all over the world; from England, France, Canada, Sweden, and Holland; from Asia and South America. Almost two hundred million dollars' worth has been received so far this year. During the war, all nations conserved their gold as much as possible: the future was indefinite and ocean transportation was perilous. But now the blackest days are past, and foreign commercial interests think it better to take steps to improve adverse exchange rates than to keep a large gold reserve. Those nations with a surplus of certain commodities are endeavoring to bring about the same result by exporting to the United States, but foreign countries have, in general, been drained so dry that it is more convenient to ship gold.

The United States has taken England's place as the creditor nation of the world, for the time being at least; and, to be paid, we must receive manufactured goods as well as gold. At present, raw materials are generally at or near pre-war prices in this country, whereas manufactured goods are roughly twice what they formerly were. This is not a healthy condition. Importations of high-priced commodities will not only help to lower prices here, but will provide resources which foreign nations may employ in buying our cheap raw materials, thereby increasing the prices. This will have the tendency of bringing our price levels more in accord.

The proposed tariff wall should not be too high to jump over; particularly for those commodities which, because of superior natural advantages of production, and not because of a lower standard of living, can be produced more efficiently in other countries.

WHAT OTHERS THINK

Converting Mixed High-Grade Matte and Copper

Referring to a correspondent's inquiry published in *Engineering and Mining Journal* of Jan. 29, and C. D. Demond's reply thereto published on March 26, under the caption "Blowing White Metal to Blister," I think Mr. Demond makes his answer too strong. The data are too few to make a generalized statement that the thing can or cannot be done, but I am sure that under some circumstances, with the conditions as given, the material could be successfully and economically converted.

In 1906 I was smelter superintendent at the plant of the Shannon Copper Co. at Clifton, Ariz., and we installed a converter plant to treat the mattes there, which did not differ materially from the matte mentioned in the correspondent's inquiry. There was a shortage of sulphur, and the matte ran from 55 to 77 per cent of copper, with the average for some months as high as 65 per cent. The furnaces, it is true, were blast furnaces, but the temperature of melted matte does not differ on account of its origin. Under the conditions referred to, the furnaces made a little black copper from time to time, and this tended to accumulate in the crucible, which was unusually deep, and also appeared as buttons in the bottom of the matte pots. Before the converters were installed it appeared in the molds and pots. The buttons were collected, and occasional black copper runs were made for the purpose of putting it into merchantable form. After the converters were installed it went directly into them.

The matte was successfully converted without serious difficulty. It was before the day of basic linings, and the acid lining would stand many charges, as many as twenty or more per lining, I believe. Practically all the corrosion was just above the tuyères.

The presence of black copper does not necessarily mean white metal for the accompanying matte. A black copper charge (and I am not referring to one in which metallic copper is added to the charge) frequently produces black copper containing 97 per cent copper and matte containing 60 or 65 per cent copper, though at times the matte may be 75 per cent or more. The latter is usually indicative of unsatisfactory furnace conditions.

In the case in question the inquirer states that the copper in his tests was in the form of shot in the matte, as a mixed mass. It seems to me that the test must have been of short duration. Copper separates readily and quickly from hot matte unless there are conditions not mentioned by him. If the matte was so cold that the copper could not separate or was itself solidified, I do not see how it was possible to tap the furnace. If it was hot enough to be readily tapped from the furnace it seems to me that there are possibilities for converting. The data are too few to make it possible to state positively.

Mr. Demond seems skeptical about the small amount of copper in the slag, and I must say that I agree with him in that, but I will not violate the principle noted and say it cannot be done. Electric smelting with a high-lime slag might do it. It is an unusual case, however, and I am afraid my skeptical nature will make me think there has been some mistake unless I am informed as to the conditions which permitted such favorable results to be obtained. C. A. GRABILL.

San Francisco, Cal.

[We hope that we may have more information from our original inquirer.—EDITOR.]

Engineer of Mines vs. Mining Engineer

This letter is, in a way, only confirmatory of much that has been published on the above subject in *Engineering and Mining Journal.*

It seems to me that the editor's note, appended to "Engineering vs. Surgery," published on March 26, however, is not quite to the point. Though we certainly should not call in a physician who had taken only a correspondence course in medicine and surgery—that is, under ordinary circumstances—if a "regular" was not available, we should much prefer a "correspondence" man to one without even such training. The value of such a one is tacitly admitted when in mining and other accidents one who has been trained in "first aid" is preferable to the rank and file. Analogously, in an important mining problem, would a "recent graduate" from even the highest technical school be preferred to a "correspondence man of long and successful experience"?

It appears to me that any one excepting a chronic, hidebound "regular" would gladly listen to one, correspondence man or not, if his past work showed him to be a master in his line.

This brings one face to face with the root of the whole discussion—"What is an engineer?" Consult the Century Dictionary, and you will find that an engineer is defined as "A person skilled in the principles and practice of any department of engineering." A second and more general definition is "One who carries through any scheme or enterprise by skill or artful contrivance; a manager."

I cannot quote exactly the person or circumstances of the following: As I recall it, the engineer of the Tay bridge was asked by the correspondent of a London daily to define "engineering." His reply was "engineering is applied common sense."

In 1902, while in Kingston, Ont., I asked the professor of chemistry in Queens College if one not a graduate of a technical school had a right to call himself an engineer, to solicit, or practice, engineering work; specifically, to consider himself a mining engineer. His reply was direct and explicit, and given with no indecision: "Such a man has no right to sign himself 'E. M.' That is a technical degree conferred in virtue of having fulfilled a prescribed course of study. He has a perfect right to call himself a mining engineer. In each case the ultimate right, skill in practice, depends wholly upon the individual."

In 1882 to 1888 I was instructor in mathematics in the Rensselaer Polytechnic Institute, in Troy, N. Y.

David Greene at that time was the "director." It often happened that after faculty meetings the director and myself had informal discussions, mainly to do with the work of the students. On one occasion the director spoke very feelingly on the subject of degrees. "We give our graduates the degree of 'C. E.' This is wrong. They are not civil engineers. They are not engineers at all. We teach them how to become engineers; they make engineers of themselves after they get out—if they have it in them."

I take it that the above quoted opinions are not simply "instances" or one-sided examples, but are sober expressions as to what really constitutes an engineer. I conclude that it is performance—doing—that constitutes an engineer, not at all the degree conferred.

There is absolutely no doubt in my mind that an engineering course is highly desirable, and is eminently helpful; there is equally no doubt that lack of a liberal education gained in a formal course is no bar to the making of an engineer. A polished bit of glass is only glass, after all; it can never be anything else. A rough diamond is something that glass can never be—a diamond—but the diamond can acquire the polish as well as the glass. The sole shibboleth is not "where did you get your degree" but "what can you do?"

This is all *ex parte* evidence, and is to be valued accordingly. I own only an "A. M." from an ordinary college. Yet for nineteen years I have signed myself "geologist and mining engineer." This was on advice of professors in one or two of the highest engineering schools in the country. Perhaps it was intended "to let the inquirer down easy." It is possible that if the professors consulted had expressed their unvarnished opinion they would have advised me to classify myself with "practical horseshoers" or "practical barbers," even if they had not advised me to be consistent and classify myself specifically with "practical mule shoers" or "practical dog trimmers," since, as a mining engineer, I have confined myself to the restricted field of "ore finder," instead of indulging in general practice.

West Haven, Conn. FRANK L. NASON.

The Mackenzie River Oil Field

In *Engineering and Mining Journal* of March 26 appeared an article on the Mackenzie River oil field, which in most respects is timely and much to the point, and I heartily concur with all that is said regarding the exercise of caution with reference to reports from that quarter. Nevertheless, I desire to take exception to it on one point. In the discussion of the geology of the region, one is led to infer that there is little else but Devonian or older formations between the "tar sands" of the lower Athabaska and the delta of the Mackenzie.

In a recent publication of the Geological Survey of Canada with accompanying map (Charles Camsell and Wyatt Malcolm, Geological Survey, Canada, Memoir 108, "The Mackenzie River Basin," 1919), it is shown that post-Devonian rocks have a considerable distribution in the Mackenzie region. Immediately southeast of Norman there is an area of Tertiary beds thirty to forty miles long by twenty to thirty miles wide; to the south these are succeeded by Cretaceous rocks which extend along the Mackenzie River on both banks for fifty miles, and nearly the whole course of the Great Bear River (east of Norman), together with the western and northwestern shores of Great Bear Lake, are underlain by rocks of this age. There are also two more areas of Cretaceous sediments of considerable extent along the Mackenzie between Norman and the delta.

It is not stated in the memoir to which reference was made that these later strata are oil bearing. They may have served, however, to prevent the escape of oil from the underlying rocks, so that the geological possibilities of the region are probably somewhat greater than would be inferred from reading the article in *Engineering and Mining Journal*. J. A. REID.

Cobalt, Ont.

Increased Living Costs and Higher Wages

From Mr. Lee's excellent article in *Engineering and Mining Journal* of April 2 on the driving costs of the Spiro Tunnel from 1916 to 1920 inclusive, it is shown that the labor cost in 1920 per foot advance was 148.8 per cent greater than in 1916, of which 49.27 per cent was due to increased wages and the remainder, or 99.53 per cent, to a slackening of effort, or labor inefficiency. Comparing the cost of materials per foot for the same years, there was an increase of 128.5 per cent. No doubt this 128.5 per cent was largely higher wages and labor inefficiency passed on and on from the producer of the raw materials to the manufacturer, and from him to the consumer.

The average workingman would bitterly resent being told that he profiteered during and since the war and would cite the fact that while his wages had been advanced in this particular case, 49.27 per cent of his cost of living had increased 100 per cent or even more; forgetting that he did 50 per cent of work for 150 per cent of pay of former years, and also that his increased living cost was largely another working man's higher wages and inefficiency passed on to him.

Park City, Utah. P. H. HUNT.

Bacillus Scientarum Popularis

The newly discovered germ, *Bacillus scientarum popularis* (correctness of Latin form not vouched for), seems to be spreading rapidly, possibly because of the unusually early spring. Fortunately, it is a beneficent germ, capable, indeed, of inducing extraordinary symptoms, but not likely to work any lasting harm to the constitution, even of the most hide-bound professor.

I have before me the current numbers of *Engineering and Mining Journal* and *Science*. The leading editorial in the former is on "Popularizing Science"; the first paper in the latter is entitled "A New Agency for the Popularization of Science." Is this collusion, coincidence, thought transference, or simultaneous inoculation with the above-named germ?

Whatever started this thing going, let us hope that the good work will continue until the scientist is willing to acknowledge the right of the layman to exist, and the layman is able to learn what the scientist is driving at.

Augusta, Me. FREEMAN F. BURR.

Costs at Las Dos Estrellas Mill

In the comparative costs at Las Dos Estrellas mill published in *Engineering and Mining Journal* of April 2, the cost of tube milling in 1920 is erroneously given as $0.2829, whereas the correct figure is $0.5829. The correction is made through the kindness of T. Skewes Saunders, Mineral de Dos Estrellas, Michoacán, Mexico.

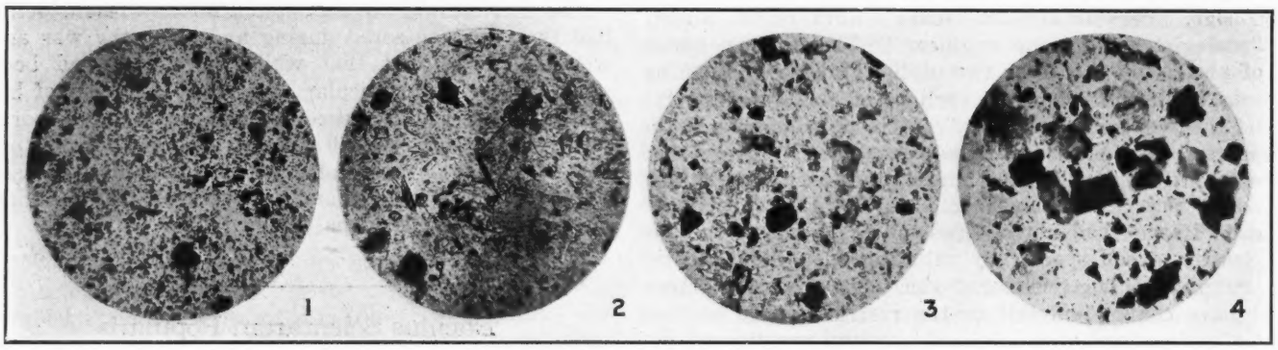
Dust Control and Ventilation in Metal Mines

Co-operative Public Health Service and Bureau of Mines Investigations of Great Importance to the Mining Industry—Increase in Labor Efficiency, and Operations in Workings of High Rock and Water Temperatures, Made Practicable by Comparatively Small Outlay to Allay Dust and Assure Pure Air

BY D. HARRINGTON*
Written for *Engineering and Mining Journal*

ALTHOUGH lack of adequate ventilation and prevalence of dust in coal mines have long been regarded as dangerous, dust occurrence and lack of moving air currents have not, until recent years, been considered particularly disadvantageous by metal-mining men in general, especially in the United States. England, South Africa, and Australia attacked the problem of dust some years ago, and the necessity of adequate ventilation was also considered, though in a somewhat less degree. South African investigation and practice in dust control was and is of much importance, and some exhaustive and interesting reports have been published.

G. S. Rice, chief mining engineer of the U. S. Bureau of Mines, became actively interested in matters pertaining to dust and ventilation in metal mines several years before much, if any, actual work was done on these subjects in the United States, and chiefly through his initiative, in 1915, the Bureau of Mines and the United States Public Health Service entered upon a study of dust in the mines of the Joplin, Mo., region, the field investigators being Edwin Higgins, mining engineer of the Bureau of Mines, and Dr. A. J. Lanza, of the Public Health Service. Reports of this work were published by both the Bureau of Mines and Public Health Service.



PHOTOMICROGRAPHS OF METAL-MINE DUST

(1) Through 280 mesh, magnified about 60 diameters. This material had very little silica and was largely copper ore in hematite. Note comparatively few sharp-pointed or cutting edges. This dust would be comparatively harmless. (2) Through 280 mesh and magnified about 60 diameters. From hard granite with about 20 per cent quartz. Particles mainly sharp and splintery, making a very dangerous dust, as the quartz present seems unusually hard and brittle, breaking into particles with cutting edges. (3) Through 280 mesh and magnified about 60 diameters. About 15 per cent quartz, remainder more or less disintegrated feldspar and hornblende. Chiefly rounded particles with a few sharp cutting edges, these generally being quartz. (4) Through 280 mesh and magnified about 60 diameters. Practically no quartz; chiefly copper sulphide ore (chalcocite). Round-edge dust predominates.

INVESTIGATIONS AT BUTTE PROMISE IMPORTANT RESULTS

In 1916, the dust study was extended by these two bureaus to the mines of the Butte, Mont., region, and the investigators, Dr. A. J. Lanza, of the Public Health Service, and D. Harrington, mining engineer of the Bureau of Mines, soon became convinced that the health problem, though largely one of dust, was complicated by important contributory factors such as high air temperatures, high humidities, and lack of air movement. The Butte study was extended through 1918, and reports of this investigation are in the press and will probably be issued soon.

In 1919, the study was continued in the mines of the Globe-Miami district of Arizona, the investigators being D. Harrington and G. E. McElroy, of the Bureau of Mines, and Dr. R. A. Koronski, of the Public Health Service. A confidential report was made on each of the mines visited and a composite report on the district for publication will soon be completed. In 1920, it was decided to further expand the work and it was divided into three separate problems, the direction of research and investigation being placed in charge of D. Harrington. The separate problems are: Metal-mine ventilation; rock dust in relation to miners' pulmonary diseases, and high temperatures and humidity as affecting the health of miners.

Mining engineers Pickard, Gardner, McElroy, Ageton, Dyer, and Forbes, of the Bureau of Mines, and Doctors Saunders and Koronski, of the Public Health Service, were assigned to this work, and, with Chief Surgeon Sayers, of the Bureau of Mines, and D. Harrington, they have participated in these investigations in various mining regions of Arizona, Montana, California, and Idaho. Some work of a similar nature has recently been done by Mr. Ageton and Dr. Kindall, of the Public Health Service, in the mines of Michigan. It is probable that the work will be extended to other states should the mining companies desire it.

Dr. R. R. Sayers, chief surgeon, and D. Harrington, mining engineer of the Bureau of Mines, have undertaken the detailed study of the effect on the human body of heat and humidity as influenced by air movement, air vitiation, and other conditions underground, as found

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in metal mines. Some of the data obtained were published in *Engineering and Mining Journal*,[1] and on Jan. 28, 1921, the U. S. Public Health Service published additional data. A more detailed underground study of this phase of the work has recently been made by Messrs. Sayers and Harrington, with especial reference to effect of air movement, and results will soon be published.

Relation of Investigators to Mining Companies

Although the co-operation of the mining companies is necessary in carrying out the work, the companies are put to practically no expense other than supplying a guide to accompany the investigators underground, the length of time spent underground generally being a few weeks for a comparatively large mine. Dust and ventilation considerations constitute the main objects of the work, but the engineers and doctors, when underground, naturally become fairly familiar with systems of mining and details (good and bad) of mining practices, and the diversified opportunities of the investigators for observation allow them to assimilate interesting information, much of which is frequently transmitted verbally to the representatives of mining companies, or possibly is given in written form in the report. Hence, the study is one of give-and-take, in which information and data are obtained by the investigator and information is likewise given out to the mine operators.

Reports on Mines Held Strictly Confidential

A separate detailed report is made on each mine studied, embodying data as to flow of air, temperatures, humidities, gases, dust formation and dissemination, analyses of air and dust, microscopic examination of dusts, and other special data, together with conclusions of the investigators and recommendations. Inasmuch as safety and fire prevention are intimately associated with dust-ventilation studies, some attention is given them, and at least a few conclusions and recommendations as to these items are included. These reports of individual mines are held strictly confidential, a copy being given the company officials and other copies being held in the confidential files of the Bureau of Mines and the Public Health Service. After several mines of a mining district or of a state have been reported on individually and confidentially, a composite report is prepared for publication, but so worded as not to identify the individual mines.

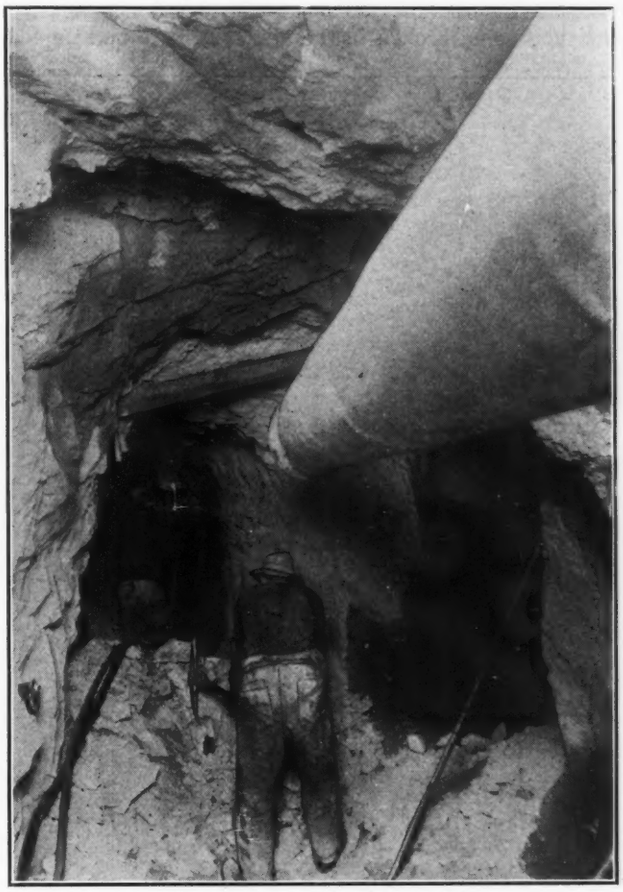
Field Methods and Apparatus

Inasmuch as it is desired to correlate a study of one region with all other regions studied, the methods adopted have been made as nearly uniform as possible, subject to change, however, when progressive ideas suggest better methods or when unusual underground conditions demand alteration of existing practice.

Bureau of Mines sling psychrometers are used to obtain air temperatures and humidities at pertinent points, as at the surface at intake openings, at various points underground, such as in intake or return air courses, or in crosscuts, drifts, raises, stopes, or other underground workings. The psychrometer is used also to obtain temperatures of underground water, especially of water dropping through the air, and also rock temperatures, both rock and water temperatures having vital effect on underground air temperatures, especially at working places where the air movement is slight.

Velocities

Air velocities are determined where possible by use of standard mine anemometers of 4 to 6-in. diameter, and readings are taken usually by moving the anemometer through the cross-section of the opening during a period of a minute, taking several such readings and averaging the result. Where greater accuracy is desired, the cross-sectional area of opening is divided into six or nine



ONE MAN DRILLING AND ONE MAN MUCKING AT FACE OF CROSSCUT IN ROCK WITH NATURAL TEMPERATURE 102 DEG. F.

The moving air from end of canvas ventilating tube allows the men to work practically without evidence of perspiration.

equal parts, and the anemometer is held stationary for a minute at each part, the average of all such readings being then accepted as the result. Anemometers are sent to Washington, D. C., from time to time to be calibrated, and velocity corrections are made from curves obtained in calibration. Where velocities are less than 100 ft. per minute (frequently the condition in metal mines), they are approximated by observing the inclination of a candle flame (after having seen the effect of various velocities on the flame of a candle), or the velocity is approximated by observing the length of time for smoke from burning fuse to traverse 50, 100 or more feet.

Pressures

Standard aneroid barometers are used to obtain barometric pressure on surface as well as in various parts of the mines. In obtaining fan-operating pres-

[1] "Physiological Effect of High Temperatures and High Humidities in Metal Mines," Vol. 110, No. 9, pp. 401-404.

sures, the readings on the aneroid barometer are checked against a portable water gage consisting essentially of a glass U-tube with several feet of rubber tubing of about ¼-in. diameter.

Air Samples

Air samples are taken of intake air at the surface, of return air at the surface, and, if possible, from various ventilation splits underground. In general, however, air samples are taken at places where men work, chiefly at faces in crosscuts, drifts, stopes, raises, or other workings. Sampling is done by breaking the tip of evacuated glass tubes of about 250 to 300 c.c. capacity, the tube being broken in the atmosphere to be sampled.

APPARATUS USED IN DUST SAMPLING MINE AIR

After the sample of air has been collected in the tube, the tip is sealed with an especially prepared wax, and the sample forwarded to the Pittsburgh laboratory of the Bureau of Mines for analysis.

Dust Samples

The sugar filter method of obtaining samples of dust from mine air has been used in these studies. In the Joplin investigations, a method of aspirating air through a small tube filled with sugar was devised by Mr. Higgins, and this was used in the Joplin and Butte work. The method by which the air drawn through the sugar tube was breathed by the sampler and the exhaled air taken into a calibrated bag theoretically gave a sample essentially similar to that breathed by the workers. However, in mine air of considerable humidity, the sugar in the tube quickly became partly saturated with moisture, aspirating became labored, and speed of breathing was likewise labored and unnatural. Moreover, it was practicable to breathe only comparatively small quantities of air per sample (about 35 liters in the Joplin and Butte work), and this quantity was so small that the laboratory determinations on the dust samples were subject to much error. Hence, in the later studies in Arizona and Idaho, the South African method of using pumps was adopted, in conjunction with a sugar tube of large diameter and aspirating 15 to 20 cu.ft. of air per sample.

Two kinds of pumps have been devised in the Pittsburgh laboratory of the Bureau of Mines: one, double-acting, somewhat like the best type of South African pump, and the other single-acting and adapted from a pump that formed a part of certain discarded apparatus formerly used by the Bureau of Mines. Though the latter is much cheaper, it is by no means as efficient as the double-acting pump.

In sampling underground the sugar tube through which the mine air passes before entering the pump is held as closely as possible to the head of the mine worker, and the pump is worked by one of the investigators at a rate of about one cubic foot of air taken per minute, or approximately the rate of breathing of a normal man when working. The sugar filters out the dust from the sampled mine air in a manner somewhat

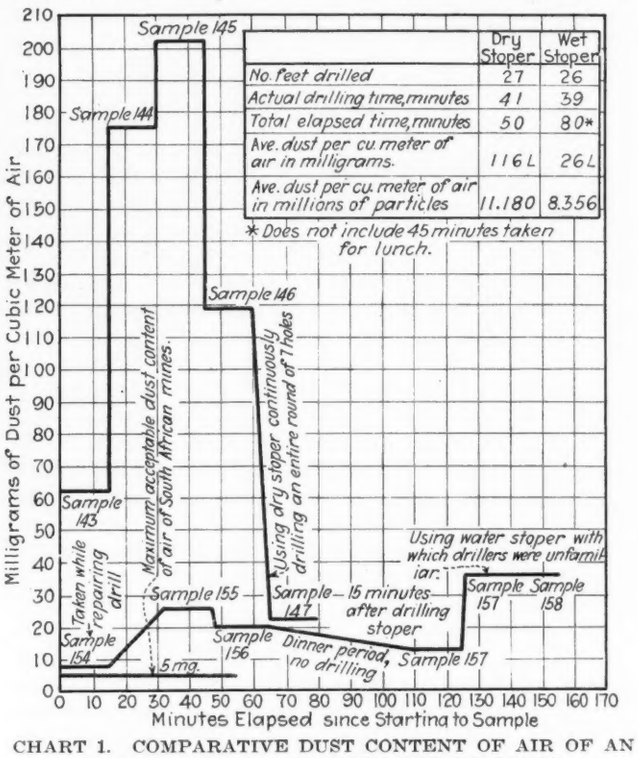

Milligrams of Dust per Cubic Meter of Air
Minutes Elapsed since Starting to Sample
Dry Stoper
Wet Stoper
No. feet drilled 27 26
Actual drilling time, minutes 41 39
Total elapsed time, minutes 50 80*
Ave. dust per cu. meter of air in milligrams. 116 L 26 L
Ave. dust per cu. meter of air in millions of particles 11.180 8.356
* Does not include 45 minutes taken for lunch.
Sample 145
Sample 144
Sample 146
Sample 143
Sample 155
Sample 147
Sample 154
Sample 156
Sample 157
Sample 158
Maximum acceptable dust content of air of South African mines.
Using dry stoper continuously drilling an entire round of holes
Taken while repairing drill
5 mg.
15 minutes after drilling stoper
Dinner period, no drilling
Using water stoper with which drillers were unfamiliar.

CHART 1. COMPARATIVE DUST CONTENT OF AIR OF AN UNVENTILATED RAISE WHEN DRY DRILLING A ROUND OF HOLES AS AGAINST WET DRILLING THE SAME PLACE

similar to removal of dust by the workers' air passages when breathing the dust-laden mine air.

Immediately after sampling, the sugar tubes are sealed by suitable corks, and then sent to the Pittsburgh laboratory of the Bureau of Mines for analytical examination. Before shipment to Pittsburgh, a few drops of formaldehyde are placed in the sugar tube to prevent fermentation, this preparation being especially necessary when the mine air is humid and the surroundings during shipment are excessively warm, as in summer.

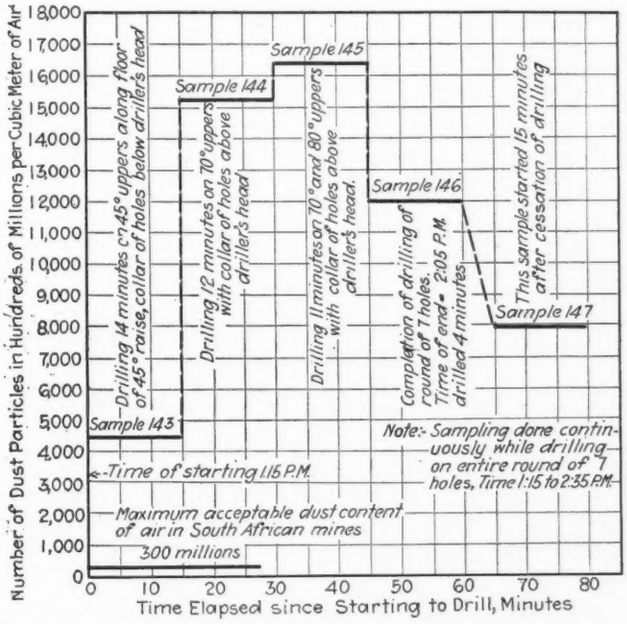

Number of Dust Particles in Hundreds of Millions per Cubic Meter of Air
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Sample 143
Sample 144
Sample 145
Sample 146
Sample 147
Drilling 14 minutes on 45° uppers along floor of 45° raise, collar of holes below driller's head
Drilling 12 minutes on 70° uppers with collar of holes above driller's head
Drilling 11 minutes on 70° and 80° uppers with collar of holes above driller's head.
Completion of drilling of round of 7 holes. Time of end - 2:05 P.M.
This sample started 15 minutes after cessation of drilling
drilled 4 minutes
Note:- Sampling done continuously while drilling on entire round of 7 holes, Time 1:15 to 2:35 P.M.
Time of starting 1.15 P.M.
Maximum acceptable dust content of air in South African mines
300 millions
0 10 20 30 40 50 60 70 80
Time Elapsed since Starting to Drill, Minutes

CHART 2. DUST CONTENT OF AIR BY NUMBER OF PARTICLES WHILE DRY DRILLING A ROUND OF HOLES IN A RAISE IN A WESTERN METAL MINE

Also shows how enormously greater is the dust content of this place than the allowable maximum dust content of mine air of South Africa. The material drilled was highly siliceous.

In addition to the before-mentioned samples of dust from mine air (from 10 to as many as 100 samples being taken in a single mine), samples of drill cuttings, of dust settlements along workings, of vein matter, and of country rock are also sent to Pittsburgh for analysis and microscopic examination, these samples each being from two to four pounds in weight and one or two of each (possibly more) being sent from each mine examined. It is also desirable to send a sample of the water used in drilling, and possibly one of the water provided for drinking purposes.

Laboratory Work

As has been heretofore indicated, practically all analytical work is done at the Pittsburgh laboratory. Air samples are given standard analysis for oxygen, carbon dioxide, methane, carbon monoxide, and *nitrogen plus other* constituents. If information is desired as to especial gases, such as oxides of nitrogen, or SO_2, or hydrogen or hydrogen sulphide, special request must be made of the chemists at Pittsburgh.

The quantity and nature of the mine-air dust entrapped in the sugar tube are determined by dissolving the sugar in a measured quantity of distilled water and filtering out and rejecting the particles over 280 mesh in size, particles over 280 mesh being known to have practically no harmful effect, as they are too large to enter the air passages at points of danger. The dust in the filtrate is then separated by sedimentation into particles *under* ten microns in size and particles ten to ninety microns (a micron being about 1/25,000 of an inch); a small part of the filtrate is set aside to be placed under the microscope, and a count of particles made and reported in millions of particles per cubic meter of air. The dust is chemically treated to dissolve soluble constituents, and is finally weighed and reported in milligrams per cubic meter of air aspirated, divisions being made as to particles above and below ten microns in size. The division at ten-micron size is made for the reason that investigators in dust work have found that seldom, if ever, are particles over ten microns in size found in lungs of miners who have died of miners' consumption.

Particles of dust from drill cuttings, country rock, vein matter samples, or other sources are also placed under the microscope, and photomicrographs are made. Reports are submitted as to quantity, size, shape, and other characteristics of particles, especially as to sharpness and cutting edges of the small particles. Also, chemical analyses are made of drill cuttings, vein matter, and other underground material incident to mining operations, with especial reference to the presence of known harmful constituents, such as silicates, free silica, or like deleterious substances, and especially free silica or any other insoluble substance breaking into fine particles with sharp edges. These analytical reports and examinations are transmitted to the investigators, who tabulate them and compile the results and interpret them, placing the tables and interpretation, with suitable recommendations, in the reports submitted on the individual mines.

Special Work of the Doctor

In general, the doctor assigned to the work accompanies the engineer into the underground workings and aids in the taking of the data, collecting samples, and in general investigations, and simultaneously obtaining data as to sanitation such as latrine system, drinking water system, and general working conditions. If it is possible to do so, the doctor makes physical examination of miners and other mine employees, with especial reference to chest conditions, including heart, lungs, and other vital organs, simultaneously taking history data

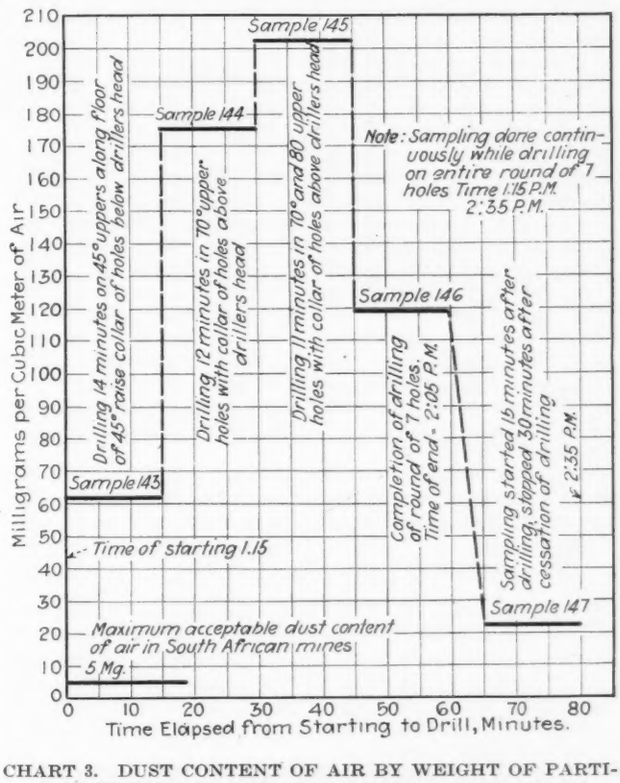

Milligrams per Cubic Meter of Air
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Sample 143
Sample 144
Sample 145
Sample 146
Sample 147
Drilling 14 minutes on 45° uppers along floor of 45° raise collar of holes below driller's head
Drilling 12 minutes in 70° upper holes with collar of holes above driller's head
Drilling 11 minutes in 70° and 80° upper holes with collar of holes above driller's head
Completion of drilling of round of 7 holes. Time of end - 2:05 P.M.
Sampling started 15 minutes after drilling, stopped 30 minutes after cessation of drilling
2:35 P.M.
Note: Sampling done continuously while drilling on entire round of 7 holes Time 1:15 P.M. 2:35 P.M.
Time of starting 1.15
Maximum acceptable dust content of air in South African mines
5 Mg.
0 10 20 30 40 50 60 70 80
Time Elapsed from Starting to Drill, Minutes.

CHART 3. DUST CONTENT OF AIR BY WEIGHT OF PARTICLES WHILE DRY DRILLING A ROUND OF HOLES IN A RAISE IN A WESTERN METAL MINE

Also shows how enormously greater is the dust content of this place than the allowable maximum dust content of mine air in South Africa. The material drilled was highly siliceous.

as to kind of work done, length of time employed in the mine as well as in other mines, and general mining experience and work. However, physical examinations are sometimes difficult to obtain. Either the mining companies or the employees, or both, object, and in such circumstances no examinations can be made. Where temperatures are high, special problems arise, and the doctor obtains data as to blood pressure, pulse, and general physical effects of varying conditions.

Results of the Dust Ventilation Work of the Bureau of Mines

Although investigations of the effects of dust and general mining conditions have been carried on for many years in foreign countries and for several years in the United States, and though considerable definite information has been obtained, much remains to be done. In the United States, conditions are complicated by many unusual factors, and the effect of these has not yet been definitely determined, but I offer the following tentative personal conclusions, with full knowledge that future investigations or even some at present in progress may change the conclusions:

Dust

1. Long-continued breathing of underground air heavily laden with any kind of dust is likely to be ultimately harmful to health.

2. Harmfulness of dust is proportional to its fineness, insolubility, and occurrence of sharp cutting edges. Dust particles over one twenty-five hundredth of an inch in size are not considered especially harmful. Particles under one twenty-five hundredth of an inch are invisible to the naked eye unless present in the air in great numbers.

3. Probably the most dangerous dust is that of free silica. Fine dust of combined silicates, though not so harmful as free silica, is also likely to have sharp cutting edges and is insoluble, and consequently is likely to have a harmful effect on lung tissue.

4. It now appears probable that though dust composed largely of free silica is likely to be harmful, there may be conditions under which the usual harmfulness of free silica dust is at least partly neutralized.

(a) Haldane advances a theory that ordinarily harmful siliceous dust may be associated with some other dust which "adsorbs" or envelops the harmful dust, and this prevents the harmful dust from acting.

(b) It also appears that free silica may exist in a state of partial alteration by heat, pressure, or other underground condition such that it is more or less decomposed, and so acts as compared to ordinary silica somewhat as decayed timber would effect solid timber.

5. Considerably over 50 per cent of present-day metal mining is done in siliceous material, and in many of the non-siliceous mines there are other dusts, both soluble and insoluble, which have bad effect on the health of underground workers.

6. Mines working in material composed largely of free silica (quartz, flint and similar rocks) or having other dangerous kind of dust, may, to a large extent, avoid harmful results.

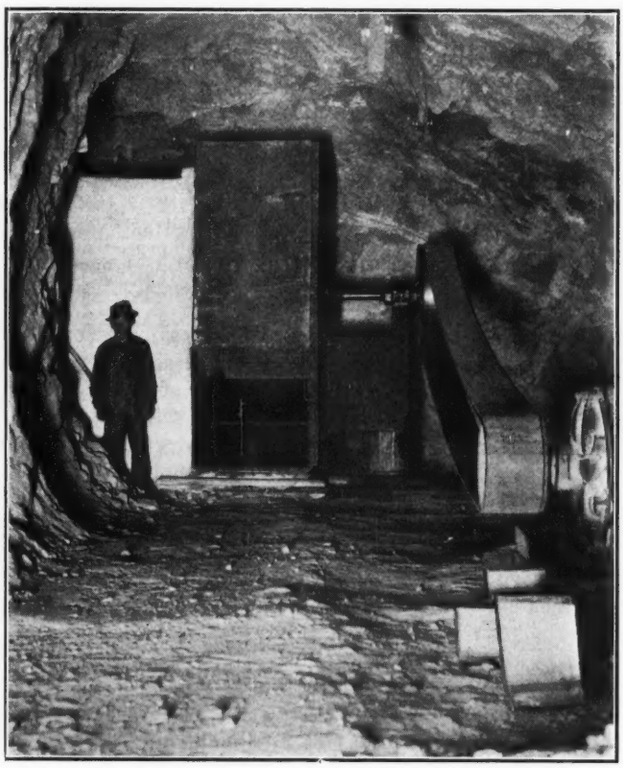
(a) Through lack of formation of dust if the material is wet.

(b) Through prevention of dust formation and its dissemination by use of water drills for all kinds of holes, including uppers, by use of water sprays, by wetting down of muck piles, roadways, chutes and other working places, by sprinkling, and also by adoption of methods of mining resulting in reduction or elimination of upper holes.

(c) By prevention of blasting when men are on shift and adoption of methods of dust allayment after blasting, and before men again come on shift.

(d) By providing ample currents of air to sweep out the dangerous fine dust as soon as it is formed. Compressed air blowers or jets, in general, do not supply sufficient quantity of air to accomplish this. Where the coal-mining method of always having an intake and a return air course is impracticable, the use of efficiently set doors, regulators, brattices, and analogous appliances, and small fans with galvanized iron or canvas tubing, readily supply sufficient currents of air to advancing blind-end faces of drifts, raises, or other workings, to clear them of dangerous dust as well as of smoke.

7. By far the greater part of the excessive unhealthfulness of workers in and around metal mines is due to dust. There is no question that the dust hazard can be eliminated, and at no undue expenditure of time, money, or effort, provided there be whole-hearted co-operation of miner and operator. In general, the metal-mine operator realizes the dust danger, but is handicapped in adoption of common-sense methods and regulations by the fact that the miner only too frequently prefers to "eat" the dust, with full knowledge of ultimate effect, rather than undergo a certain amount (frequently temporarily) of physical discomfort in using dust-prevention or dust-allaying devices. This attitude on the part of the miner has made inoperable practically all the state laws heretofore adopted to assure the elimination of dust in metal mines, and little progress can be made until the miner realizes the necessity of helping to protect his own health.



AN EFFICIENT FAN INSTALLATION 3,000 FT. BELOW THE SURFACE

Ventilation

1. Ventilation of metal mines was until recent years considered a "fad" or an impossibility, but widespread, earnest attention is now being given to it.

2. In general, even the better ventilated metal mines of the present day fail utterly to provide really adequate ventilation. Large quantities of air are coursed through the mine, with little or no attention to bringing moving air to the actual working faces, and the worker only too frequently must leave his working place to obtain the benefit of ventilation expenditures. Seldom can moving air be found at as much as 25 per cent of the working faces of a metal mine, and this is true even when considerable money is spent on ventilating equipment.

3. The old-time "hard-boiled" metal-mine foreman or superintendent cannot be relied upon to introduce adequate ventilation methods or systems. He has probably mined many years without ventilation, and therefore sees no need for it. Moreover, he has not the technical knowledge or the special experience to handle the problem, and the work should be intrusted to a young engineer who has had ventilating experience in either a coal or a metal mine and who preferably reports to the higher officials, who want results and are not likely to be governed by prejudices. The old-timer as foreman or superintendent, according to my observation, is likely to try to block progress rather than to facilitate it. There certainly can be no effective ventilation of metal mines until ventilation equipment, methods, upkeep, and direction and control are placed in the hands of some one man who spends practically all of his time in direct touch with the work, and is under instruction to keep moving currents of air at all times at all working places in the mine.

4. All mines should have mechanical ventilating equipment, with main fans placed preferably on the surface in fireproof housing, and with suitable arrangement for prompt reversing of air current if an occasion should develop making that necessary.

I am of the opinion that no mine can be adequately and *safely* ventilated by natural ventilation. Even assuming that there may be no effect on naturally ventilated mines due to change of seasons (and this assumption cannot be borne out by facts), the mine with natural ventilation is

USE OF BRATTICE IN A METAL MINE

likely to be seriously, probably dangerously, handicapped if a mine fire should occur. This is now recognized by many progressive mining companies, and fans are being placed even where it is felt that natural air currents are sufficient for ordinary ventilation.

5. Providing efficient ventilation is fully as important to the ultimate financial success of a metal mine as is the adoption of a proper system of mining, or of haulage, or of mill or metallurgical treatment. This may be considered a radical statement, but I have in mind several properties in which the workers simply cannot deliver more than one-fourth to one-third of a decent day's work because of unfavorable (almost unendurable) air conditions. Yet there are near-by mines with essentially as bad natural conditions in which men work at top speed because of good ventilation installation.

I know of mines with abundant ore of better than ordinary grade that have been abandoned because it has not been possible to work them, owing to high rock and water temperatures. On the other hand, other mines with even worse natural conditions are working successfully through maintenance of adequate ventilation, and at a cost of but a few cents per ton of ore produced. Many metal mines that are today getting only 30 to 50 per cent efficiency from their men, because the men are compelled to work in hot, humid, stagnant, or vitiated air, could readily provide decent, healthful working conditions by making a comparatively small outlay for ventilation, and be reimbursed several times over annually in greater efficiency of their men, as well as in compressed air saved, fire protection afforded, and other economies.

Importance of Specifications for Chemical Lime

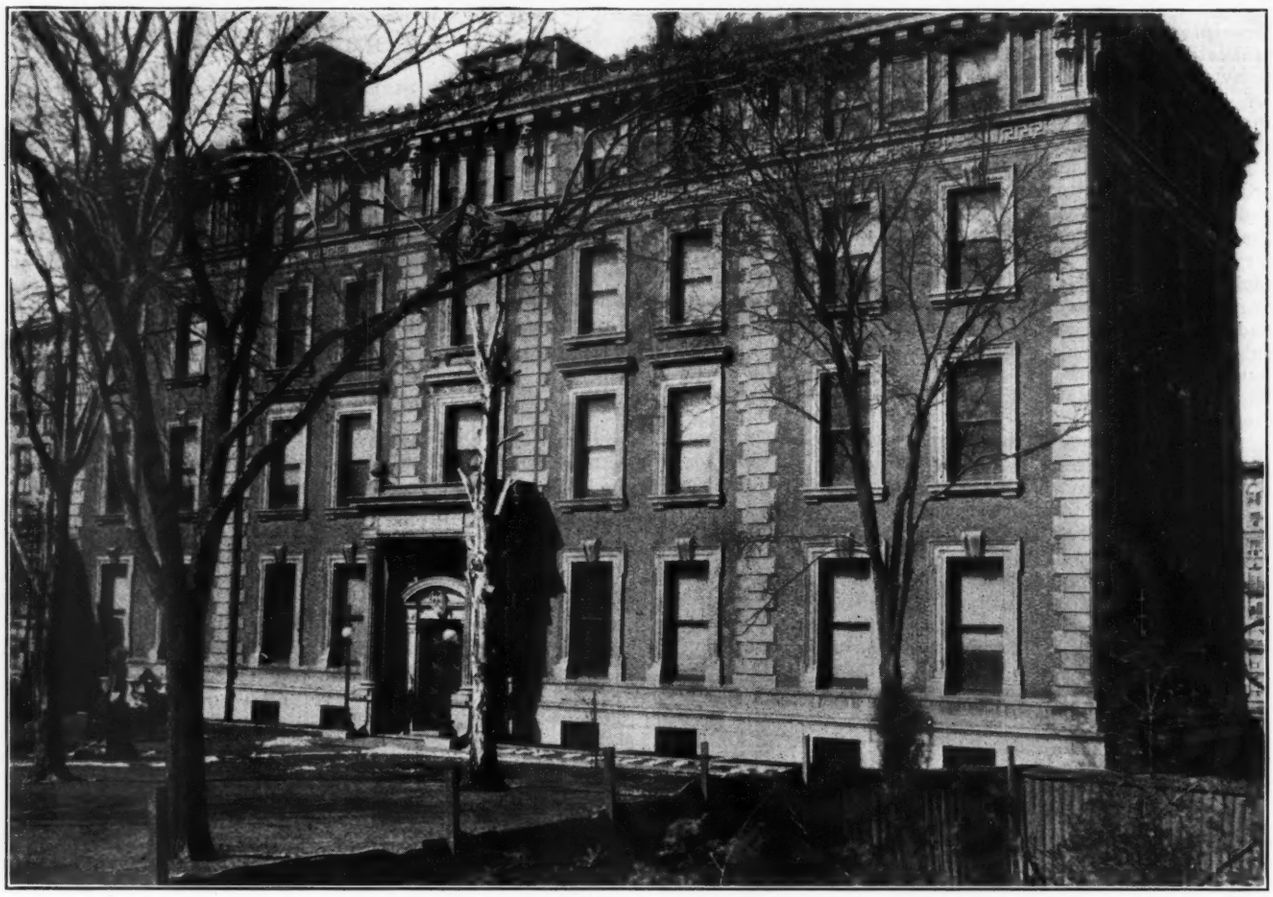
Urgent Need for Standardization of Lime for Various Uses—Government Co-operating With Consumer In Recommending Specifications

LIME, hydrated lime, and limestone fill a very important place in the industrial life of the country. It is estimated that approximately 140 different industries use lime in some form. It is becoming more and more apparent that there is great need of improved standardization of the material used for various purposes. The requirements are so diverse that a lime which is satisfactory for one use is found to be entirely inadequate for another. Many firms are using types that are inferior for their purposes, partly through ignorance of plant practice and partly through lack of information as to where material of the proper grade may be obtained.

A better standardization of materials would probably have the effect of establishing better plant operation through the dissemination of knowledge of details of approved practice, and would enable producers to prepare lime better suited to the requirements of the trade. It would also tend to cut down transportation costs, for the user would in many cases be enabled to obtain suitable material from a more convenient source than at present.

The great need for detailed specifications led the Bureau of Standards to call a meeting of representatives of various Government bureaus to discuss the feasibility of working out a standardization of requirements. As a result, an Interdepartmental Conference on Chemical Lime was organized, with representatives from the Bureau of Standards of the Department of Commerce, the Bureau of Chemistry of the Department of Agriculture, the Geological Survey and the Bureau of Mines of the Interior Department, and the Nitrates Division of the War Department. This conference holds meetings at intervals of about a month, at which specialists in the use of lime in various consuming industries present specifications for general discussion. Tentative specifications are then submitted to the industries and to competent organizations for approval or criticisms. When completed, they are published by the Bureau of Standards. One such specification, that recommended for quicklime and hydrated lime for use in cooking rags for the manufacture of paper, has already been issued as Circular No. 96. Several additional specifications are now nearing completion.

It is desirable to emphasize that the work of the Interdepartmental Conference in no way conflicts with or overlaps similar work conducted by the American Society for Testing Materials and the Specifications Committee of the Lime Association. In fact, the approval of the latter organizations for specifications prepared by the Interdepartmental Conference is sought and obtained. The preparation of complete specifications consumes much time, and it is felt that the field is so tremendous, and the need so great, that there is ample opportunity for several groups to work for years without conflict. The conference is careful to select only those industries for which the other organizations are preparing no specifications, thus avoiding duplication of effort.



COLUMBIA UNIVERSITY SCHOOL OF MINES BUILDING

The Columbia School of Mines Idea

Its Principal Tenet Is That the Education of a Mining Engineer Should Include Sound Preliminary General Training—A Six-Year Course Necessitated by This Plan

BY GEORGE J. YOUNG
Written for *Engineering and Mining Journal*

SINCE the beginnings of technical education there has been contact with industry, but this contact was more or less casual until technical graduates and employers became increasingly insistent upon the need for a knowledge of the practical or, I might say, "going things" in the industry. The requirement that an engineer should be practical or should temper his judgment with a background of practical experience has been generally accepted, and mining schools have endeavored in various ways to meet this requirement.

Laboratory instruction in tool sharpening and rock drilling, excursions to mining districts, experimental adits, and talks by experienced engineers and mining men, greater amplification of laboratories, with introduction of large-scale appliances such as were used in milling operations, as well as the requirement that students should work in mines and mills during a part of their vacation periods, comprise some of the efforts to develop the practical aspects of a mining education.

Contrasted to this conception of educational requirements is the theory that the cultural development of the engineer has been neglected and that some effort should be made by the schools to broaden the engineer's outlook upon life. A part of the curriculum of mining schools has always been devoted to cultural subjects, but this has been in many institutions a diminishing quantity as an increasing amount of time has been spent in laboratory work.

Along with this latest movement is a related one that I foresee will engage the attention of educators. It is also in line with cultural development. Though difficult to state in simple terms, it comprises the following: A greater appreciation and knowledge of the human element in industry, a conception of the fundamentals of sociology, a knowledge of psychology, fundamental training in hygiene, housing, and living, a broad foundation of the economics of mining and industry as well as of business, and a more extended knowledge of what I might term the civil contact of industry; meaning by this, corporation, business, and regulatory laws, which have developed both in numbers and complexity during the last decade.

As a phase of the endeavor for greater cultural development there is also an insistence for higher quality in

the product of the schools. There is, among the advocates of the broader training, the feeling that quality heretofore has often been sacrificed to quantity. Many educators have felt the pressure to increase attendance and have reluctantly trimmed their sails to meet the exigencies of their individual situations. Now, however, the growing need for better quality is meeting some recognition, and the more progressive institutions are going through a process of introspection which will in time raise educational efficiency and result in meeting the needs of the students more specifically.

A curriculum may be well thought out and balanced, and may function like a modern piece of artillery, or it may resemble an old-fashioned stage coach, filled with a heterogeneous mixture of humans, parcels, and trunks, creaking along in top-heavy fashion and somehow getting to its destination, although with a certain degree of misery to its occupants. Most mining schools have workable curricula, which require only additional change as educational ideas advance. The principal function of the curriculum is to serve as a systematic base and equitably to divide the students' time.

With the object of renewing my acquaintance with mining education, I recently visited the School of Mines of Columbia University. Through the kindness of friends there I was enabled in the limited time available to meet almost all members of the faculty and to learn at first hand some of the important developments that have taken place in that school.

The Columbia Plan of Graduate Schools

Columbia University has established in its technical schools a six-year course, the first three years being the basis of a liberal education and the last three being devoted to technical studies. This represents a departure from the conventional four-year university course so commonly found in engineering schools. The motive back of this departure was the desire to afford better preparation for entrance to the technical school. This motive can be traced to the movement to provide a greater cultural background for the technical man.

The segregation of the curriculum into two parts makes possible the service of two objectives specifically. The work in Columbia College has for its objective the training of men in fundamentals such as physics, chemistry and mathematics, languages, and other pertinent subjects. It is designed to be superimposed upon a well-balanced high-school course. Its product becomes the raw material for the technical course. There are no limits to what is loosely termed a general education. There are, however, practical limitations in a college course, such as available time and the students' receptive capacity.

After attempting to work out the intricacies of the college course for School of Mines men, I have the feeling that much can be done in presenting it in a clearer manner than has apparently been considered necessary in the existing catalog. However, as it is, the presentation may contribute to the intellectual development of the student, or perhaps it is a modern intelligence test that may operate to prevent the entrance of the victim unable to fathom it.

The technical course in mining and related subjects at Columbia, in common with the other schools of engineering, is organized under Dean George B. Pegram. He told me that the plan contemplated a working enrolment of 350 in the various technical branches, with an annual output of 100. About half the incoming technical students are expected to come from outside colleges and half from Columbia. Under the previous system the number of technical students totaled 800 as its maximum. The proper care of this number under the present courses would tax the capacity of staff and laboratories beyond their limit. Dean Pegram pointed out his conception of the college course in making it possible for a student to make a wiser selection from the technical courses. Of the technical courses in relation to the college course, he stated that the objective was to train men to be leaders and men of affairs.

The curriculum of the mining school is plainly presented. Three separate courses for the engineer of mines, the mining geologist, and the metallurgical engineer are provided. Each specialized branch is an important one. The courses are sound, and the arrangement is consistent. There is about an even division between classroom and laboratory time, and the total time in any one session is not far from thirty hours. Summer work is provided for at the end of the first and second years. A fair degree of contact with the industry has been provided.

Edward F. Kern took me through the metallurgical laboratories. I formed the impression that pyrometallurgy was the leading subject for the moment and that hydrometallurgy had slipped into second place. The assay laboratories under Professor Hall, placed fortunately at the top of the building, are splendidly equipped for good instruction and rapid work.

I met William Campbell, who handles metallography. Professor Campbell believes that engineering students should know something about the materials they are using. In his judgment, this study of materials is just as important as calculus. He is an authority on his subject, and has turned out some able men.

With Arthur L. Walker, professor of metallurgy, I had an interesting conversation. Professor Walker belives in giving a student an opportunity to think for himself. He requires each student at some time in his courses to prepare three lectures on assigned subjects and present them to the class. Robert M. Raymond, professor of mining methods and mining engineering, who came to his educational work after an extended experience in operating mines, discussed the question of contact of the student with the mining industry. The students are encouraged to get practical work as early as they can, and most of the men comply, using their summer vacations for this purpose. At the end of the second year, a six weeks' excursion is taken under the direction of Professor Raymond, and this excursion brings in contrast a number of mining districts. During the session short trips are taken to near-by iron and coal mines, and the students study at first hand the construction work in the subways of New York. A surprising variety of mining and metallurgical operations is accessible from New York. Robert Peele, professor of mining operations and mine plants, has had a large field experience and has been on the educational staff of the School of Mines for twenty-eight years. He is a mining educator and writer and represents the student and scholar. To finish off an exceedingly interesting day, I dropped in on Professor Charles P. Berkey. In response to my request Professor Berkey initiated me into the mysteries of cultivating geological ability in students.

Columbia University has collected in this School of Mines an able, experienced, and balanced faculty. There

appear both the scholastic type and the practical engineer. The individual members are men that one would like to know, and I felt that the ideal which Columbia is endeavoring to meet, in turning out graduates who will be better leaders and who will advance the technical side of industry by reason of their thorough preparation and sincere purpose, is in excellent hands.

We know, of course, that the wisdom of the six-year mining engineer course is an open question, which is far from having been generally accepted. Possibly even some of the faculty at Columbia have their doubts. Naturally, there are adherents of the old order as well as enthusiasts for the new. The new program started under the difficulties imposed by the war, and has not perhaps had a fair trial. There is a surprising scarcity of students. Some believe that six years is too long a time for a technical student to remain in college. But the idea is, at any rate, an interesting experiment, which will doubtless be carried to a logical conclusion, and there should be as definite an accounting of the results as possible.

Back of this experiment there is a record of achievement that has placed Columbia University among the leading universities of the United States. The relatively great expansion of local opportunities for technical education has operated competitively against the long-established and strong institutions. Will the new order change this, and will the flow of first-class material set in toward institutions like Columbia? Or, will Columbia be impelled to change its plans, and adopt for its mining engineers a course of training approximating more nearly that of the Western mining schools which have found this course successful? Or will the Harvard idea of a four-year course, or the Massachusetts Institute of Technology plan, concerning which I hope to write more later, turn out to be the successful compromise?

A Defect in the Pittman Act

Minor Assay Offices Required To Pay Foreign Silver Price for Domestic Silver Purchased—Small Producer at a Disadvantage in Obtaining $1 per Ounce

Written for *Engineering and Mining Journal*

THE PITTMAN ACT provides that silver of domestic production presented at the Assay Office in New York or at one of the coinage mints shall be purchased by the Government at the price of $1 per fine ounce. As a consequence, domestic silver is quoted in the New York market at 99½c. per ounce, whereas foreign silver is 60c.—more or less—depending upon the London price.

The price to be paid for silver contained in gold bullion is fixed from time to time by the Director of the Mint, under authority of R. S. Secs. 3520-3526. Exercising this authority, he has made a standing order that such price shall conform to the New York quotations, but has modified this to the extent that although the New York Assay Office and coinage mints pay $1, in accordance with the act, the minor assay offices must pay, for all silver purchased, even though known to be of domestic origin, the New York price quoted for foreign silver.

It is not intended for a moment to question the motives of the Director. It must be assumed that the exclusion of the assay offices was intentional; but it may be contended that they would not have been excluded had conditions been understood. Unquestionably, the Director has authority to pay the New York market price for domestic silver, and a large number of small producers would receive the benefit of the advanced price were payments also made through the assay offices.

As the matter stands, the producer who happens to be operating near Denver or San Francisco can deliver his bullion to the mint and receive $1 per ounce, whereas the producer situated near Seattle or Helena or Boise derives no benefit from his proximity to those assay offices, and must either pay additional transportation on his bullion to sell it at the mint, or accept the lower price which is all the local office is authorized to pay. Thus, the usefulness of these offices is impaired at the very time when the mining industry is most in need of encouragement and support.

Also, the miner who is producing smelting ore may sell his ore to the smelter and receive $1 per ounce for his silver, whereas his neighbor whose rock is free-milling deposits his bullion at the assay office and receives only the foreign price.

Unfortunately, it is the small operator who suffers from these inequalities, as in many cases he cannot wait for returns from a distant mint, but must sell his product to the nearest assay office; and there are instances where consequently considerable losses have been sustained; in fact, every one depositing bullion of domestic origin at a minor assay office must pocket this variable loss of from 40 to 45c. per ounce.

It is not known why the minor assay offices were excluded from the provisions of the Pittman Act, but it has been suggested that because of the danger of our being swamped with foreign silver disguised as native, the act was confined to the mints and the New York office, with the view that thus only four places would require watching. If this is the reason it is without merit, because the amount of silver contained in the gold deposits purchased at these offices is negligible when compared with the total amount of silver purchased by the Government; and the officers at these offices know practically all of their customers and the sources from which this bullion is derived, so that any unusually large deposits would at once excite suspicion and inquiry.

The obvious remedy is for the Director of the Mint to authorize the minor assay offices to pay for silver in gold deposits of known domestic origin, the New York price for domestic silver; or to amend the Pittman Act so as to make the minor assay offices pay for silver contained in gold deposits of domestic origin the same price as the mints pay under this act for silver purchased for coinage.

Oil Reserve Distinctions

Present output and future reserves of petroleum must not be confused in the study of mineral statistics, warns the U. S. Geological Survey. In the main, present national rank is indicated by production, but the fact that mineral resources are not replaceable is always a qualifying factor. This distinction between present and future is especially important when such a topic as national domination in oil is under discussion: that North America contributes 85 per cent of the world's supply of petroleum is no proof that Persia and Mesopotamia may not contain half as much oil as the United States and Mexico, even though those countries of the Near East are now yielding only 2 per cent of the world's output. Indeed, in this matter of mineral wealth, the nation that is a spendthrift today is so much the less likely to possess "independent means" tomorrow.

The Tom Reed-United Eastern Decision

Case Involved Novel Question of Apex Mining Law, According To Judge Bollinger—Mallery Fault Responsible—Many Eminent Geologists and Practical Men Testify at Trial—Defendant Wins

A DECISION in favor of the United Eastern Mining Co., of Oatman, Ariz., defendent in the apex suit brought against it by the Tom Reed Gold Mines Co., was handed down on March 28 by Judge Bollinger, of the Mohave County Supreme Court, as already announced in the news columns of *Engineering and Mining Journal*. The attorneys for the plaintiff, Tom Reed, were the late Judge Curtis H. Lindley, William E. Colby, and the firm of Wallace & Lucas. Witnesses for the Tom Reed were: Ely Hilty, Steven Smiley Jones, Herman C. Zulch, Fred W. Crosley, Oscar H. Hershey, W. B. Phelps, manager; Walter H. Wiley, Albert Burch, and Andrew C. Lawson.

Attorneys for the United Eastern were: John T. Gray, R. L. Alderman, and C. W. Herndon. The defendant company's witnesses were: George Keating, Edward L. Haff, W. D. Dower, Fred Searls, Percy G. Harrison, John A. Burgess, William H. Emmons, William S. Winstead, and Horace V. Winchell.

The decision reviews the case from the first. The substance of it is given in the following excerpts:

This is a very interesting and remarkable case. It is not only an unusual case in the history of Arizona jurisprudence, but a case that presents problems of the mining law which have never been adjudicated by any court.

The issues in this case present a suit to quiet title to an underground vein or orebody situated beneath the surface of the Big Jim mining claim, which claim is patented and owned by the defendant. The plaintiff owns the Grey Eagle and Bald Eagle mining claims and they are, also, patented; and said plaintiff is claiming the ore in question by its alleged extralateral right under what is known in mining parlance as "the apex law."

The action of the Mallery fault is the cause of this lawsuit. A fault is merely a vein which is not mineralized. Dr. Lawson, during his testimony, gave a very interesting lecture upon the phenomena of faulting and discussed at some length some of the fundamental principles of such phenomena. The court read with a great deal of interest his views and the views of other high authorities upon this interesting question. It seems that faulting results from strain which accumulates in the rocks of the earth. This strain is sometimes caused by one thing and sometimes by another. Two of the most important causes of this strain are the operation of temperature within the rocks and the moving of weighty material from one place to another on the surface.

Therefore we have established in the Oatman district two fissure systems: the older system which was mineralized, as exemplified by the Tom Reed vein which traverses the Grey Eagle and Bald Eagle claims of the plaintiff, and the later system which is not mineralized, as exemplified by the Mallery fault. The mineralization which occurred in the earlier fissure and produced the Tom Reed vein was an interesting process. That fissure contained moving underground hot water. Because this water was hot and came in contact with sulphur and thereby formed a chemical solution, which solution was capable of mineralizing a fissure by circulating and depositing elements contained in this solution throughout the fissure, therefore we conclude that a fault in geology is nothing more nor less than a break in the continuity of the body of rock, which break is attended by a movement on one side or the other of the break so that what were once parts of one continuous rock stratum or vein are now separated. This movement which separates the stratum may be in more than one direction; that is, there may be both a downward displacement and a horizontal heave, as is found in the Mallery fault. The amount of displacement in each movement may be a few inches or thousands of feet.

The vein which traverses the Grey Eagle and Bald Eagle claims lengthwise, and what the plaintiff has called the "first segment" of the Tom Reed vein, has its apex within the surface lines of those claims. Since the first of the year 1916 the plaintiff has mined the ore from this vein to a depth of 600 ft., and at that depth the vein stops abruptly against what is known as the "Mallery fault." At the bottom of the vein the ore is bent upward on the hanging wall of the Mallery fault. At a distance of about 430 ft. from the 600 level of the Grey Eagle the orebody which the defendant terms the "Big Jim vein," and which the plaintiff terms the "third segment" of the Tom Reed vein, stops against the foot wall side of the Mallery fault. The ore in this vein is bent downward. The top of this orebody is about 200 ft. beneath the surface of the Big Jim claim. In order to reach the main orebody within the Big Jim the plaintiff would either have to travel up the Mallery fault a distance of 430 ft. from the 600-ft. level of the Grey Eagle, or crosscut through country rock, mostly beneath the surface of the Big Jim for about the same distance.

There were a number of eminent geologists and mining engineers who testified in this case, many of them not only with national but international reputations. A few practical miners also testified and furnished the court with very valuable information, because the problems involved in this case are largely practical ones. After listening to the testimony of the geologists, and after reading and rereading the same, the court is of the unqualified opinion that at some time in the dim and distant past, the orebodies beneath the Tom Reed property and the orebodies beneath the United Eastern property were once connected as a part and parcel of the same general fissure and vein system, but this court has no information as to just how many thousands or how many millions of years have elapsed since that condition existed, but that it at some time in the past did exist seems to be the opinion of all the expert witnesses on both sides. But when the faulting occurred as the result of the formation of the Mallery fault there was not only a downward displacement of approximately 430 ft., but there was a horizontal movement along the strike of the vein, the extent of which is not known, and the best proof which could be introduced as to the size of the horizontal component would be nothing more reliable than a wild guess. For instance, there is nothing before this court that any part of the vein along the 600 level within either the Grey Eagle or Bald Eagle claims was ever attached to any part of the top of the vein as found at the 200 level within the surface of the Big Jim claim. About the only testimony on this point was to the effect that the horizontal movement was greater than the downward displacement.

This case involves nothing more than a novel question of the apex mining law. During the course of the trial there was not much dispute or serious conflict between the expert witnesses on both sides. The essential facts relating to existing conditions as found in the premises were practically admitted.

Every man is required to keep his hands off of any and every thing within the surface lines of a claim belonging to another, which surface lines extend vertically downward, until he sustains the heavy burden of proof that he is working upon and following the vein which has its apex within the surface lines of his claim. This apex right only accrues and attaches to the vein of any claim when said vein may be identified on its downward course and when it is a continuation of the same vein outside of the lines of his claim that it is within the lines of his claim; in other

words, in order to assert this right of apex the vein outside must be identified with and a continuation of the vein inside of the lines. . . . If veins are separated permanently and cannot be followed as the same vein, and if it is necessary to pass through great distances of country rock in order to connect them, in which distances there are neither mineralized walls nor seams, such veins must be deemed separate and distinct ones and cannot be identified as one and the same.

This case must be decided from a practical viewpoint as the miners find conditions in the ground today, or it must be decided upon the theories and testimony of geologists in accordance with conditions as they existed many thousands or millions of years ago. If the decision be based upon the theory and testimony of the geologists it seems to me that no mining location in the Oatman district could be secure or valid. The fundamental purpose of the apex law was to give the miner what he found.

We are reliably informed by geologists that this northwest section of Arizona, including the San Francisco mining district and Oatman, experienced at some time in the past a great upheaval and sank about 6,000 ft. With this in mind the court is compelled to view this case from a practical standpoint and adopt the views of the practical miners, and view the conditions as they are today and as they were when the rights of all parties herein were acquired.

As stated before, the three essential conditions to be established in this case are, *identity, continuity* and *continuity of right*. . . . The plaintiff introduced a great deal of convincing testimony as to identity. Among other things it proved that the ore is abruptly cut off and exists on opposite sides of the Mallery fault, that the strike and dip of the various orebodies are very similar, that the vein-filling is virtually the same, that the wall rocks are similar, and that on the hanging-wall side of the Mallery fault the ore is bent upward while on the foot-wall side of this fault it is bent downward. But the plaintiff did not identify the ore which is located beneath the surface of the Big Jim claim as the continuation of its vein known as the Tom Reed vein which stops abruptly against the Mallery fault on the 600-ft. level of the Grey Eagle and Bald Eagle claims. This identity and continuity of the Tom Reed vein within the plaintiff's ground into the ground of the defendant was not proven and could not be proven if, for no other reason, than because it would be impossible to ascertain the extent of the horizontal movement at the time of the formation of the Mallery fault. When a locator locates a mining claim his claim is limited to 1,500 ft., and his apex or extra-lateral rights are also limited on that claim to the same distance. These rights may be limited to a much shorter distance.

The testimony of all the geologists who testified in this case shows that the continuation of the Tom Reed vein on the foot-wall side of the Mallery fault is at least over 400 ft. from where it was once connected and attached to the Tom Reed vein, and probably several thousand feet from either the Grey Eagle or Bald Eagle claims. . . . A fault which causes a downward displacement of over 400 ft. and a horizontal component of that much displacement or a great deal more, destroys the identity and continuity of the vein and deprives the apex owner of his continuity of right to follow that vein under such conditions into the land of an adjoining owner. . . .

The court finds that within the premises in question there exist at this time three separate and distinct veins or ore bodies; namely, the Tom Reed vein, the Sideline vein and the Big Jim vein. These veins are permanently separated, have been so separated for many centuries and each of them possesses an individuality of its own. The only physical connection that they ever had in past ages was that each of these veins or orebodies at some time in the distant past constituted a part of one main fissure or vein system which was disrupted by the Mallery fault. So far as the testimony in this case shows, it would be impossible for any geologist, either by positive knowledge or through the agency of geological projections to locate the actual physical continuation of the Tom Reed vein. This same condition exists as to the Big Jim vein with reference to the ore which at one time constituted the upward extension of this vein. The Tom Reed or Grey Eagle vein is wholly within the ground of the plaintiff, has its apex within the ground of the plaintiff and is owned by the plaintiff. The Big Jim vein is wholly within the ground of the defendant, has its apex within the ground of the defendant and is owned by the defendant.

Suppose that this court should adopt the view and theory that this case should be decided from the standpoint of origin, at the time when these veins, lodes, ledges, faults and apices were formed, would it not be just as reasonable and legal to go beyond the Mallery fault period to other times and other ages and have the geologists read the story of the rocks back to the time of creation? There were no doubt prehistoric times when the premises in question presented very different conditions from those portrayed at the time of the formation of the Mallery fault or immediately preceding that time. . . . In other words, if this case should be decided upon the theory of origin, the plaintiff would not own the Tom Reed vein as found within the Bald Eagle and Grey Eagle claims, but that property might be successfully claimed by some owner of barren ground a few thousand feet away.

Record Production of Borax in 1920

The quantity of borax produced and sold in the United States in 1920 was 35,280 short tons, valued at $5,674,000, according to R. C. Wells, of the U. S. Geological Survey. This is a record production and value, exceeding even those of last year—28,518 tons and $4,351,891—which were higher than those of any previous year.

For many years borax has been manufactured in the United States from the mineral colemanite, a calcium borate, which is mined in California, but for the last two years some borax also has been obtained from the water of Searles Lake, Cal., as it is one of the salts that the brine yields by a certain method of treatment. This method of treatment marks a departure in the borax industry and recalls the old days in the 60's when borax was made by recrystallizing the crude salt found in the mud of Borax Lake.

The total quantity of crude borates produced in the United States in 1920 amounted to 120,320 tons, valued at $2,173,000. This is a record in quantity, though not in value, on account of the lower grade of the ores.

Borax, called in chemistry sodium tetraborate, is used in large quantities in making the enameled coating for cast-iron and steel ware used in plumbing fixtures, chemical equipment, and kitchen utensils. It is also a constituent of borosilicate glasses, such as are employed in making lamp chimneys, baking dishes, and laboratory glassware. Considerable borax is also used in the laundry and kitchen, in making soap and starch, in paper sizing, and in tanning and welding.

In the United States a considerable quantity of boric acid is made from borax as well as from colemanite. Boric acid is an antiseptic, and is used in cosmetics. It is also employed to preserve meats under conditions permitted by the Food and Drugs Act.

The price of borax in 1920 as quoted in the New York market, for crystals in bags, in car lots, averaged about 9½c. a pound. The price in 1919 was about 8½c. a pound.

Borax was produced in the United States in 1920 by the American Trona Corporation, 233 Broadway, New York City; the Pacific Coast Borax Co., 100 William St., New York City; Chas. Pfizer & Co., 81 Maiden Lane, New York City, and Thorkildsen, Mather & Co., 111 West Monroe St., Chicago, Ill.

The West End Chemical Co., at Searles Lake, expects to begin marketing borax in the near future.

CHROME ORE CARAVAN IN ASIA MINOR

Mining Chrome Ore in Turkey

American Operators in Macri District Planning an Output of 100,000 Tons Annually Of Mineral Running From 40 to 45 Per Cent Chromic Oxide and From 6 to 8 Per Cent Silica—Methods of Mining, Transportation, and Loading Primitive but Cheap

BY RUFUS W. LANE
Written for *Engineering and Mining Journal*

MACRI, on the coast of Asia Minor, opposite the Isle of Rhodes, is mentioned in history a thousand years before Christ. It has a beautiful harbor, almost completely surrounded by high mountains. Across the entrance to the harbor is a small island, which leaves a narrow passage, but one sufficient to permit the entrance of the largest ships, and where the water is sixty fathoms deep.

A town of 6,000 inhabitants, divided into one-third each of Turks, Jews, and Greeks, nestles at the foot of the mountains. On the cliffs back of the town one sees caverns, tombs, and shrines cut into the rock many centuries ago. This little city lives from agriculture and chrome mining, the latter being the chief source of revenue. There are many chrome mines in this district, but only five of them are near enough to the sea to make their operation profitable.

The three largest chrome mines in the neighborhood are worked by an American corporation, Lane, Reggio & Co., Inc., with headquarters at Smyrna. Of the output about twenty thousand tons is shipped to America yearly, the remainder going to Europe. The mineral is about 80 per cent lump and runs 40 to 45 per cent chromic oxide, with 6 to 8 per cent silica. The mines are operated on long lease and are all open workings, and under present conditions produce roughly 25,000 tons a year.

The present operators expect to increase this output to 100,000 tons when political conditions become such that plans already drawn up for installing an endless cable can be executed without fear of government interference. The quality is much liked by American metal works, and commands a good price. Modern docking and loading facilities are absent, and all ore is lightered out to the ship and dumped into the hold in baskets. Operating six lighters and three winches, a ship can take on 400 to 500 tons per day. Facilities for weighing are also lacking, as the "way bridge" of the company was seized by the Turkish government during the war, and present political conditions are such that the installation of a new one would invite a similar fate.

An estimation of weights approximately within 10 per cent correct is the best that can be expected. The Turkish government collects a royalty on all minerals exported, and its functionaries control the quantity by using a "steel-yard." They weigh out, say, twenty tons of ore in sacks and put it on board a lighter; then they make a mark at the water line. Each lighter is then loaded to its water mark and the number of loads made by each lighter is noted.

LOADING SHIP A FAMILY EXCURSION

The water marks of the ship then control the day's work. While loading is going on the ship's officers amuse themselves on shore, where game is abundant. A bag of twenty red-leg partridges is not unusual, and in winter there are large numbers of woodcock. Wild boar abound at all seasons. As the actual port of shipment is some miles north of Macri, the stevedores and passers are usually embarked at the town, to the number of 200 or 250, and transported by the steamer to

the loading port. The laborers frequently take their entire families with them, and all camp on the shore while the ship is being loaded.

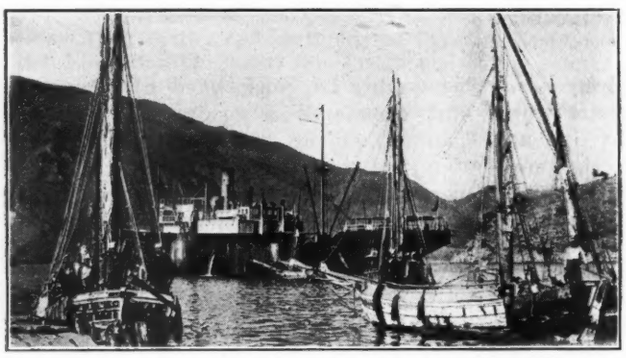
The women are occupied in mending sacks and the children hold the sacks open while they are being filled. The mineral is transported to the lighter in these sacks, lightered out to the ship, and then emptied into the slings.

The arrival of a steamer, which happens about every month, is a festive occasion, and the whole business of loading is made a kind of picnic. The Turkish government functionaries always accompany the steamer to the port of loading, and like our American darkies, delight in showing authority. They do not, however, treat the people badly, and in this region, at least, they are far from being the bloodthirsty killers one reads about in the American papers.

Workmen are recruited from the neighboring villages, and the supply is ample. A day's wage for a good miner is about $1.10. Before the war it was much less. There are practically no labor troubles. Formerly many annoyances were caused by the government. In recent months, however, the operating company has been able to work without difficulty and on the best of terms with government officials.

Land Transportation by Camel Train

The country being without railways, and much broken, all transport from the mines to the sea is by camel. This is not as expensive as it would appear, for the camels get most of their food from the leaves of the abundant undergrowth with which the mountains are covered. Each camel train in the caravan com-



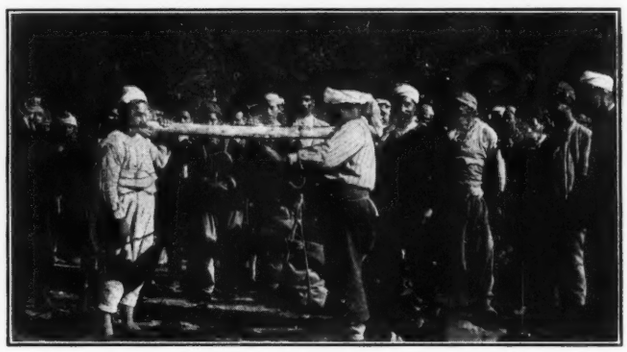
LOADING CHROME ORE AT MACRI FOR SHIPMENT TO AMERICA

prises about seven camels, a donkey to lead and a Turk as driver. A camel carries from 500 to 600 lb. of ore in sacks, tied to a cumbersome but comfortable pack saddle. The leading camel is usually a large male, and on festive occasions he is decorated with showy harness and ornamental trappings, in which bright red cloth is always a prominent feature.

The driver sits on the donkey at the head of the train and smokes half of the time, sleeping when he is not smoking. The leading camel thus acquires a taste for tobacco, and I have seen a camel inhale tobacco smoke with every sign of pleasure when a lighted pipe was held to his nostril. The camel at the end of the train always has a bunch of bells hanging to his saddle. Their constant jingle serves to sooth the slumber of the driver, and the cessation of the music never fails to rouse him, as this is a warning that there is a break in the line behind. Each camel is led by a light cord attached to his halter and also to the saddle of the next ahead. When a break occurs the camel whose halter cord has snapped always stops, and thus brings all those behind him to a standstill.

Drivers Must 'Ware the "Adamjili"

The camels are usually docile, and respond to gentle treatment, but they are stupid and stubborn. After experiencing abusive treatment a camel will carry a grudge for a long time and wait his chance to get revenge. Camels have often killed an unkind driver with a blow from the long, powerful hind leg or by crushing his head with a single bite. Such camels are always thereafter muzzled, and are known as "Adamjili," or man killers. The value of a full-grown



TURKISH GOVERNMENT OFFICIALS CONTROLLING THE WEIGHT OF CHROME ORE BEING SHIPPED FROM MACRI TO PHILADELPHIA

female is about $500 and the duration of life from fifty to sixty years.

On Fridays, this day being the Turkish Sabbath, a fight between camel bulls of rival drivers is the chief diversion of the people, and bets are freely made. The fighting is really wrestling, as the beasts are always muzzled to prevent serious injury to each other. Danger cannot, however, always be avoided, as the camels try with unexpected intelligence to get a strangle hold, and often succeed. When this happens pandemonium breaks loose, the owners in great excitement endeavoring to separate the fighters, as would a referee in a boxing match. A broken neck or leg has sometimes been the result, but the contest usually ends with one of the fighters taking flight and being chased by the victor, amid the hoots of the villagers.

Causes of Alaskan Mining Depression

The very marked decline of the mining industry in Alaska has been noted with concern by many who are interested in the territory, and has been especially unwelcome to the general public because it came at a time when the Government was expending large sums of money on a railroad that is intended primarily to open up the mineral resources of the interior. This decline is not due primarily to local causes, however; it is largely the result of the world-wide industrial conditions brought on both by the war and by the readjustments that have followed it, according to the U. S. Geological Survey.

Aside from the improvement in general and world-wide economic conditions, the chief need of the Alaska mining industry is cheaper and better transportation, including not only a reduction of the rates on existing lines but the extension of land and water routes.

BY THE WAY

Handy Knowledge

At the O'Sullivan mine, in Delaware, the following device has been successfully used to avert the sad results that customarily attend the falling of a cage. The circular shaft is 50 ft. deeper than the lowest level. A steel cylinder 20 ft. long has been built in the sump, its diameter being the same as that of the shaft. This is provided with a piston, the rod of which, projecting above the cylinder, carries a platform of the shaft diameter. A high-pressure air line carried down the shaft from the level above connects with the bottom of the cylinder by means of a plate valve. The flow of air into the cylinder is controlled by a valve in the line, just below the station above, the handle of the valve projecting out into the hoisting compartment. A falling cage on passing below the station automatically turns on the air, thus raising the piston and platform below to cushion the shock. This device was thoroughly tested by F. X. O'Shaugnessy, the master mechanic, who had such faith in his invention that he deliberately cut the rope upon the occasion when Mrs. O'Shaugnessy's mother was making her maiden trip underground. Another advantage attendant upon its use is that cheaper hoisting ropes may be used. A falling cage is now regarded merely as a passing incident at the O'Sullivan mine.

A carrot of symmetrical shape and sufficient weight makes an excellent plumb bob. If too light for use on windy days or in strong drafts underground this may be remedied by melting down some of the spare pieces of the laboratory platinum and inserting the metal as a weight in the carrot. A pin in the end will permit accurate centering. Where mules are used for underground haulage, it will be well to soak the bob in a strong solution of formaldehyde. The bob may then safely be left hanging from station plugs in the back as long as may be necessary. This same precaution should be taken at properties where there are no mules but where Cousin Jacks instead are employed.

Mineral collectors will be interested to note in the *Commercial Gazette*, of Calcutta, that olivine may be obtained for half the price of *ghee*, and is used in cooking in all the leading hotels in that city.

Frames covered with stout chicken wire are useful for placing over the top of winzes or other airways so situated as to be a source of danger. It was only luck that kept one shifter from plunging 100 ft. to the level below on more than one occasion when he was a bit under the weather.

After years of experiments the Krupp laboratories have succeeded in producing a non-corrosive steel alloy, containing over 70 per cent iron, also chromium and nickel. Among the many purposes for which it may be used is that of making false teeth for people troubled with acid mouth. A neat coat of enamel, as in the manufacture of bath tubs, gives the proper finish. The Standard Sanitary Manufacturing Co. may undertake to turn out a line of this sort of stuff. An effort to standardize sizes may also be undertaken and metric measurements used. People so equipped will require merely the services of a painter instead of a dentist when repairs are necessary.

The Chemical Show

"The Rôle of the Chemist in Relation to the Future of Our Supplies of Liquid Fuel" was a subject that received much attention at the American Chemical Society's meeting at Rochester last week. Incidentally, the large number of raids by the New York police has made it necessary to add several hootch analysts to the city's laboratory staff. The rôle of the chemist is thus fairly well defined in the metropolis.

The analysis of an unfermented Jerusalem artichoke was discussed by A. T. Shohl. Under the law, every Jewish family is allowed several gallons of wine per month for sacramental purposes, a fact that stuck out during the discussion.

R. H. Carr told the audience what it is that puts the pop in popcorn. The paper was disappointing to many, who had come expecting to take a new recipe home with them.

Other interesting papers were, one on "Blue Eyes," by W. D. Bancroft, and one on "Bleaching," by J. Merritt Mathews. The pips received due attention from Messrs. Whitby and Walker, who discussed "The Influence of Piperidine-piperidyl-dithiocarbamate." After this the congregation went home. The next meeting will be held in Milwaukee, in the Pabst Auditorium.

A Technical Error

"A backsight is better than a foresight," said Lot's wife as she surveyed Sodom and Gomorrah. Thus she earned her salt.

Interesting Facts

The three great nickel districts of the world are the Sudbury district, in Ontario; the Subway district, in New York; and New Caledonia. The production of the second is expected to increase soon.

A course in public speaking for mule skinners should be added to the Phelps Dodge Educational Course. Classes might be conducted every Sunday during the slack period.

Sufficient Unto the Day

"W'ile I did take a good drop o' beer, m'son, h'in tha days w'en 'er wuz to be ad, an' a noggin' o' good whiskey naow an' then," said Cap'n Dick, "still I can't h'abide this 'ere 'ome-raised stuff that some folks be drinkin'. 'Pears to me poor Tom Davey would 'ave been h'able to satisfy 'is curiosity 'ad 'e h'only lived a few years longer. Tom did dearly love 'is beer—fac' is, 'e 'ad tha drinkin' 'abit an' 'ad un bad. One evenin' 'e came 'long tha street baout 'alf maudlin' an' staggerin' a bit w'ile Jim Treloar an' me stood talkin' front o' a h'Italian saloon. 'Com'es 'long do, thee chaps, an' 'ave drop o' beer,' sez Tom, startin' for tha door. ''Old fas' a bit, Tommy,' sez Jim, 'This 'ere Dago keeps poor beer. Le's we go foorth to 'Arry James place.' 'Poor beer, is un?' sez Tom. 'Com'es on, then, you, w'ile I try un. I've 'ad gallons 'pon 'ogs'eads o' beer in my time, but never ad no poor beer.'"

New Talc-Grinding Capacity in the United States*

Question Is Raised Whether More Grinding Plants Are Advisable, in View of a Narrow Market For Talc Products—Stimulation of The Industry Suggested

BY RAYMOND B. LADOO
Mineral Technologist, Bureau of Mines

THE TALC-MILLING CAPACITY in this country is being expanded so rapidly that it becomes important to inquire into the probable effect that the additional production to be expected from this increased capacity may have on the industry. From information now available it appears that at least nine companies have recently built, are now building, or are considering building increased talc-grinding capacity to the extent of about 500 tons per day, or 150,000 tons per year. Of this new capacity, 235 tons per day is already built, though no production resulted from it in 1920; 85 tons is now under construction and nearing completion, and 180 tons is under consideration. In addition to the tonnages definitely accounted for, several other companies are considering expansion and several have recently been incorporated.

The estimated total consumption of our maximum year, 1920, was about 237,000 tons, or 790 tons per day. Of this total, about 24,000 tons was imported, reducing the domestic production to about 213,000 tons, or about 710 tons per day. Unless a high protective tariff on talc is enacted, imports will increase rather than decrease. Thus, the maximum consuming capacity for domestic talc to date may be taken at about 700 tons per day. However, it cannot be assumed that 1920 conditions will be repeated in the immediate future. The new capacity of 320 tons per day which may be expected to be in operation this year would add to our peak production more than 45 per cent, and, with the prospective 180 tons, more than 70 per cent. The increases over the previous maximum production of about 198,600 tons in 1917 would be respectively 55.5 per cent and 83 per cent.

The erection of some of the new mills may be justified by the fact that through improved milling methods their product will not be forced to find new markets, but will merely replace that from older but less efficient mills. Also, some addition to grinding capacity is undoubtedly justified by the normal increase in demand and by the abnormal increase of the last few years. However, after making due allowance for these considerations, it is evident that the great increase cannot be absorbed through our present channels of consumption, and additional construction seems unwise at this time unless definite new markets are first established. Instead of increasing the plant capacity, a better policy would be to spend available capital in improving mines and mills to produce a better product at a lower cost, to consolidate small inefficient companies into larger and more efficient units, and to pay for research, investigation, and publicity which would develop new markets and uses and expand older ones. Regardless of further additions to capacity, it is not probable that present plants can run to capacity unless new uses and markets are developed. Despite the record demand for 1920, several long-established mills were unable to run at anywhere near their capacity, on account of power shortage and ore shortage. Although it is impossible to run all mills at their theoretical capacity, it is evident that present mills when run at even average efficiency would produce far more talc than present markets can absorb. Running mills at a small fraction of capacity is wasteful and expensive.

The difficulty noted is not found in the talc industry alone, as is evidenced by the condition of the zinc, asbestos, and other industries. The zinc producers, through the American Zinc Institute, have adopted an aggressive campaign of research and publicity to expand their market. The asbestos interests have recently formed an association of companies engaged in the mining, jobbing, manufacturing, and finishing of asbestos and asbestos goods, known as the Asbestos Industries. The purpose of this organization is to expand the markets and uses of asbestos through investigation, research and large-scale educational publicity. The Talc and Soapstone Producers' Association can do much to remedy the condition of the industry if it has the proper backing and support, but so far this support seems to have been lacking.

*Reports of Investigations, U. S. Bureau of Mines.

Graphite Production Increased in 1920

The quantity of domestic flake and amorphous graphite sold by producers in the United States in 1920 amounted to 9,510 short tons, an increase of 28 per cent over the quantity sold in 1919, and with a value of about $626,201, as compared with $778,857 in 1919, according to the U. S. Geological Survey. Operators in Colorado, Nevada, and Rhode Island reported sales of 4,694 short tons of amorphous graphite in 1920, at an average price of $10.60 a ton. This was $3.52 per ton less than the average price in 1919. The sales of crystalline graphite in 1920 amounted to 9,632,360 lb., valued at $576,443, as compared with 8,086,191 lb., valued at $731,141, in 1919. The average price per pound in 1920 was 5.9c.; in 1919 it was 9c. Alabama led in the production of crystalline graphite, the sales in 1920 amounting to 4,894,648 lb., or 51 per cent of the total quantity sold in the United States. The sales reported from New York and Pennsylvania amounted to 3,552,687 lb., or 37 per cent of the total in the United States, and the remaining 13 per cent was reported from California, Montana, and Texas.

The Acheson Graphite Co. reported the sales of 7,399,749 lb. of artificial graphite, which it manufactured at its plant at Niagara Falls, N. Y., compared with 8,163,177 lb. in 1919, 9,182,272 lb. in 1918, and 10,474,649 lb. in 1917.

DOMESTIC GRAPHITE SOLD IN 1915–1920
(Short Tons)

Year	Amorphous — Quantity	Amorphous — Value	Crystalline — Quantity	Crystalline — Value	Total — Quantity	Total — Value
1915	1,181	$12,358	3,537	$417,273	4,718	$429,631
1916	2,622	20,723	5,466	914,748	8,088	935,471
1917	8,301	73,481	5,292	1,094,398	13,593	1,167,879
1918	6,560	69,455	6,431	1,454,799	12,991	1,524,254
1919	3,379	47,716	4,043	731,141	7,422	778,857
1920	4,694	49,758	4,816	576,443	9,510	626,201

GRAPHITE IMPORTED INTO THE UNITED STATES IN 1920( )

Country of Origin	Quantity (Short Tons)	Value
Ceylon	9,204	$1,077,290
Madagascar	4,710	286,383
Canada	2,170	157,015
Mexico	3,659	131,832
Chosen (Korea)	810	29,936
Italy	137	5,072
Austria	58	1,195
Germany	30	2,502
Other countries	317	20,087
Totals	21,095	$1,711,312

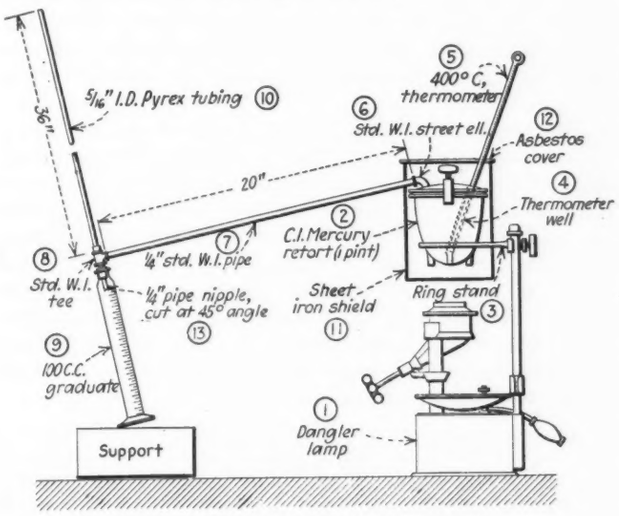
(a) These gures re preliminary and subject to revision

HANDY KNOWLEDGE

Retort for Assaying Oil Shales

A retort for assaying oil shales for oil yield has been devised by the U. S. Bureau of Mines and is described by L. C. Karrick in one of the Bureau's *Reports of Investigations* for March. It is recommended for field and labaratory use where rapid assays are desired with duplicates agreeing within 1 per cent. The retort comprises the following essential parts.

1. Dangler lamp, one-gallon capacity, or a Fisher or Meker gas burner.
2. One-pint capacity cast-iron retort (commonly known as an amalgam retort).
3. 3-in. ring support.
4. ¾ x 3½-in. pipe, sealed by welding at one end (to be screwed into lid for thermometer well; is convenient but not necessary).
5. Mercury thermometer; range 0 to 400 deg. C.
6. ¼-in. street ell; screwed into lid.
7. 20-in. length of ¼-in. galvanized pipe.
8. Tee, ⅜ x ¼ x ¼ in. galvanized; the ⅜-in. opening up.
9. Graduated glass cylinder of 100 cc. capacity, with glass stopper.
10. 36-in. length of ⅜ to $\frac{5}{16}$ in. glass tubing, with a one-hole cork to fit ⅜-in. opening of tee (8).



RETORT FOR ASSAYING OIL SHALES

11. Sheet-iron jacket.
12. Asbestos jacket covered with 1-in. hole at center.
13. ¼ x 3-in. galvanized pipe nipple, cut at 45 deg. angle on plain end, and provided with a one-hole cork, to fit on nipple and into graduate.

All pipe threads should be turned up tightly with a mixture of pulverized litharge and glycerin. The top and bottom connections of the tee (8) with the reflux condenser (10) and with the graduate (9) should also be well sealed with the same cement.

The preparation of the retort, its operation and the measurement of the oil accumulated are described in the report in part as follows:

Extreme care should be exercised in the preparation and maintenance of the contact surfaces of the lid and base of the retort. The surfaces will not form a gas-tight fit when new, and this defect must be remedied by grinding the two parts together by hand, using emery dust, as in grinding cylinder valves. The grinding is facilitated by clamping the lid in inverted position on a table and pressing down forcibly on the base while rotating it. After grinding, clean the parts thoroughly with gasoline or other light solvent, clamp the lid in place, then test the improved contact by immersing the retort in water and forcing air into the delivery tube with the lungs. If small air bubbles appear, the leakage must be repaired. Try readjusting the lid, and if this does not stop the leakage, repeat the grinding. The first preparation of the contact surfaces may require one-half hour to an hour's time, but once an air-tight contact is produced, a slight grinding before each run will keep the surfaces in perfect condition. The improved surfaces will form a gas-tight contact if kept perfectly clean and aligned while tightening down the clamp.

It is important to use a sheet-metal jacket around the retort while heating, leaving about ¼-in. clearance at the sides and enough to clear the clamp screw on top. Notches are cut in the jacket for ring support and delivery tube. A cover of asbestos board is necessary to reflect heat down against the retort lid; otherwise oil will condense on the inner side of the lid, and drip down onto the shale in the retort, thus causing losses by secondary distillation.

OPERATION OF THE RETORT

Crush the shale to pass a ¼-in. screen, and weigh out just enough to fill the retort (2) level full. Tamping the charge into the retort is permissible, and will not affect the results; this, however, is seldom necessary, and experience has demonstrated that it is better to permit the charge to rest loosely in the retort, as some rich shales intumesce or coke together, and removal of the residue in such cases is extremely difficult. After the lid is fastened carefully in place and tested for leakage as directed above, place the retort in ring support (3), adjust jacket (11) and cover (12), start the burner (1), then fasten the graduated cylinder (9) and reflux condenser (10) tightly in place. Use a small flame at first, so that no oil will appear within forty-five minutes after starting. Forty-five minutes is about the minimum time in which the shale charge can be brought up to the initial distillation temperature and yet possess a fairly even temperature throughout. Some shales begin to yield vapors at approximately 250 deg. C., whereas others show no signs of oil vapors until 375 deg. C. is reached. Before distillation makes any considerable progress, the interior or coolest shale should be at least as hot as the vaporizing temperature of the oil evolved; otherwise, vapors will migrate to the central or coolest part and condense there, causing losses of oil by cracking on redistillation of the condensed oil.

When two or three cubic centimeters of oil have accumulated, the flame should be increased, as it is imperative to distill rapidly, once oil vapors start to evolve. If the flame has been of such size that oil first appears in about forty-five minutes, it will then be safe to double the size of the flame and thereafter every twenty to forty minutes increase the heat by an equal amount. The oil should accumulate in the graduate at a uniform rate.

It should be remembered that the quantity of oil recovered will vary for the same shale sample if the rate of retorting varies, the greater quantity being obtained with rapid retorting, and, conversely, a much less amount with a long distillation period. With the average oil shale, the recovery, when the actual oil-producting period is approximately two hours, will be 5 per cent greater than when distillation lasts for six hours. When distillation is completed in less than two hours, there is danger of inaccuracy from exceeding the condenser capacity, and, undoubtedly, from decomposition of oil vapors by excessive temperatures. . . . If oil droplets appear dangerously near the top of the reflux condenser (10), the rate of heating must be retarded slightly.

THE PETROLEUM INDUSTRY

Oil Possibilities in Montana

BY L. S. ROPES
Written for *Engineering and Mining Journal*

DEVELOPMENT of natural resources, in any locality, depends upon a number of factors. Until an emergency arises, or until a sufficient number of these factors have attained a value which makes for economic importance, the resources lie unrecognized, or at least unconsidered from a commercial point of view. Market, transportation, and environment, which affect labor and living conditions; fuel and power—each has its weight in the final analysis. Thus it has been with prospecting for oil in the northwest.

Sporadic efforts at prospecting for oil at widely separated points have been made in Montana over a period of several years. Oil seeps and gas domes, here and there, have been known, gas wells have been brought in, but conditions were not ripe. Oil was at a low price in the markets of the country; and locally the demand was too limited for extensive production and refining. Transportation facilities were lacking, and there was an ample supply from the mid-west oil fields.

Prior to the war, an era of railroad building made large sections of the state accessible. The war and the extended use of crude-oil products in traction and transportation have increased the demand, the price has risen, and alarmists point to the "early" exhaustion of producing sections. Also, the state has been more generally settled, affording labor and transportation facilities.

FAVORABLE OIL FORMATIONS NOTED IN SEARCHING FOR COAL FIELDS

During the period from 1908 to 1910 I was engaged in making examinations for the General Land Office, with particular reference to occurrences of coal. At the time the work of the U. S. Geological Survey had not been extended over the state, and it was necessary to correlate formations and trace out some of the coal fields so as to be able to make intelligent recommendations. In the course of examinations along the north border of the Bull Mountain coal field, and during the construction of the Chicago, Milwaukee & St. Paul Ry., I noted the structural conditions and pointed out the possibilities for oil in the country to the north of the Musselshell River from west of Roundup to east of Melstone. This is the area of the Cat Creek, Flat Willow, Devil's Basin, and other anticlines and of the first and most actively producing and exploited oil field of the state. In 1914 the geology of this area was reported in Bulletin 541-H, Bowen, U. S. Geological Survey, and the anticlines were noted, with maps. The report, though referring to coal resources, will be found interesting to investigators of oil geology.

Broadly, the geology of the plains region of Montana is that of the Gulf States and the Mississippi Valley. The same oil formations extend to the Continental Divide and, along this, northwesterly into Canada. Before the mountain uplifts the Carboniferous and Cretaceous formations extended farther west. Isolated areas of these formations are found beyond the mountains and in areas between ranges.

AREA OF THE FIELD

Present rough limitations of the formations mentioned follow a line from the Wyoming oil fields along the northeast slopes of the Bear Tooth Mountains, south of the Yellowstone River, along the East Gallatin on the headwaters of the Missouri and with its waters to the foot slopes of the Rocky Mountains, west of Great Falls, and thence along this range into Canada.

The continuity of this boundary is broken by the Bridger Mountains, north from Livingston, from the bend of the Yellowstone, and beyond by the Big Belt and Little Belt Mountains extending along east of the Missouri River to forty miles south of Great Falls. There are some favorable areas of Cretaceous between these mountains and the main range. The western shore of the post-Cretaceous sea followed the above lines.

Off shore, and of post-Cretaceous development, are a number of uplifts throughout the Great Plains region, most of them of volcanic origin. Erosion has exposed igneous rocks, and these have been notable as centers of metal mining. North of Lewistown, in the center of the state, are the Judith Mountains, with a number of important gold and silver-lead producers. To the west are the Moccasin and South Moccasin Mountains, both of volcanic origin and prominent because of the Kendal gold deposits. The Little Rockies lie to the north of these and of the Missouri River.

GOLD MINING FORMERLY PRINCIPAL INDUSTRY OF REGION

Interest in the region has centered in the large deposits of low-grade gold ores, open quarry mining, and leaching after coarse crushing, as well as in narrow, high-grade gold veins. Northwest of the Little Rockies the Bearpaws rise above the plains, also of eruptive origin and containing metalliferous deposits. Beyond the Bearpaws and close to the international border are the Sweet Grass Hills. Returning to Lewistown, the Big Snowy Mountains are observed just to the south, an uplift without apparent volcanic associations, but, rather, related to the uplift of the Little Belts on the west. Between these and the Yellowstone River, comprising some of the highest peaks in the state, the Crazy Mountains stand out by themselves, masses of igneous rocks and uplifted sediments, the latter intersected by numerous dikes. The Bull Mountains, south of the Musselshell River, with other similar eminences, are the result of broad folding and erosion. The Big Horn Mountains complete the border line in the southeastern part of the state, extending into

Wyoming and Dakota and leaving a broad area of Cretaceous to the west.

The significance of these island-mountain features is noted in the folding and faulting of the sediments in their neighborhood. The Bull Mountain syncline and its converse on the north of the Musselshell, within which are included the Cat Creek, Flat Willow, and other superimposed anticlines, are attributable to the mountain-forming agencies responsible for the Judith and Big Snowy Mountains; the Havre oil and gas field anticlines to the Bearpaws; Chouteau, Stillwater, and others to folding and faulting, with the upheaval of the main mountain ranges mentioned. Aside from these, broad anticlines have been noted and traced far afield from immediate mountain-building influences, though they may be attributed to the same general disturbances, the effects of which must have been extensive. These structural features have produced ideal conditions for the accumulation and confinement of oil and gas.

Cretaceous Favorable to Oil Retention

The mountain ranges mentioned, the isolated volcanic uplifts and erosion, have afforded exceptional opportunity, over a vast expanse of country, for the study of the extent and continuity of the Carboniferous and Cretaceous formations. The Carboniferous is generally found to be prolific in fossils; the Cretaceous, the oil-bearing formation, with its sands and shales, especially favorable to the storage of oil and gas.

From the Musselshell at Melstone, westerly the Kootenai sands lie at from a few hundred feet to 3,000 ft. below the surface, the surface varying from an elevation of 3,000 ft. above sea level to 5,000 ft. In the eastern and southern sections, except bordering the mountains and isolated uplifts, there is a heavy overburden of younger formations, but a general lowering of surface elevations, with the drainage in an easterly direction, elevations ranging from 2,000 to 3,000 ft. above sea level. Under the more favorably situated anticlines in this part of the state, the sands probably lie at depths of from 2,000 to 3,500 ft.

It is but natural that attention should first be attracted to the shallower occurrences, because of oil seeps and gas domes, surface indications of the presence of oil formations. That deep-seated formations have been generating oil and gas through the ages, and throughout the extent of these formations, has been demonstrated at widely separated "structures" from the extreme southeast to and beyond the Canadian border.

Three essential factors in relation to petroliferous deposits have been established: the presence of formations favorable to the derivation of oil and gas has been confirmed throughout the Great Plains region; mechanical conditions essential to the formation of favorable structures were extensive, and evidence of the structures is found in the superimposed strata; and oil and gas have been found at widely separated points. The next stage is in its infancy. One field has come into production of oil, another of gas, and a veritable army of derricks is being delivered or erected throughout the entire area discussed.

A feeling of confidence has been established in the shallower fields, and deeper drilling is being undertaken in other districts. It is in the deeper-lying sands, under broadly sloping anticlines, that search will be made for the larger, more productive and longer-lived oil and gas fields of the state. In some of these the oil will be confined below sea level, and, backed by the long, gentle slopes of the formations, the water pressure should insure a natural flow of oil over a long period of productivity.

The epidemic of irresponsible wildcatting is passing, and legitimate undertakings, amply financed, as well as large operators from eastern and mid-west fields, are undertaking serious prospecting. The coming season promises to be one of exceptional activity in these fields, and another natural resource has attained its opportunity.

Recent Oil Litigations

Special Correspondence

Two suits over oil lands, in which damages claimed amount to millions of dollars, have been filed recently. The Texas Exploration Co., of Houston, Tex., has filed suit in the Federal Court to recover $1,000,000 damages. The defendants named are the Sinclair Consolidated Oil Corporation, the Sinclair Consolidated Oil & Gas Co., the Sinclair Oil & Gas Co., the Sinclair Gulf Oil Co., and the Sinclair Refining Co. It is alleged by the plaintiff that it entered into a contract with the defendants in 1918 by the terms of which it was to receive one-sixth the value of all oil produced from certain land in the Damon Mound oil field of Brazoria County, Tex., after a certain debt had been paid.

At Homer, La., suit was filed on April 15 in the State Judicial Court by Frank M. Walker, of Tarrant County, Tex., against the Standard Oil Co. of Louisiana, and the Gilliland Oil Co. of Oklahoma for the possession of certain lands in the Homer oil field estimated to be worth $4,000,000. The land at present is in the possession of the two oil companies named.

Oil Development in Arkansas

Special Correspondence

The Cave City Leasing Co., which has been holding a block of 35,000 acres in the vicinity of Cave City, Ark., has negotiated a drilling contract with the Big Six Drilling Co., of Little Rock. The consideration was acreage, the leasing company turning over all but 5,000 acres. The latter company will also retain a one-half interest in the well. Drilling will start as soon as a rig can be built and the tools shipped in. The contract calls for a test hole 2,000 ft. deep.

Work is progressing on Adams No. 1, which is being drilled three miles east of Bateville by Fulk and Riffle, of Little Rock. Another outfit has been shipped to sink another hole on this company's acreage.

There is keen interest in oil development all over the state. About fifty counties have operations under way or in immediate prospect. It is estimated that a total of 175 rigs are in operation in Arkansas at this time. The Eldorado field, in Union County, now has thirty-three producing wells.

Oil Drilling in Washington

Special Correspondence

Interest is being taken in local oil possibilities to the extent of active drilling operations at Clayton and Wild Rose Prairie, a few miles distant from Spokane, Wash. Drilling for oil is still being continued by the Colville Valley Oil Co. at Chewelah, sixty miles north of Spokane.

Book Reviews

World Atlas of Commercial Geology. Part I: Distribution of Mineral Production. Paper; 13½ x 10½; pp. 72; maps, 72. U. S. Geological Survey, Washington, 1921. Price of Part I, $2.

This atlas, of which Part I has just been issued, is the latest published expression of the work begun in December, 1917, by the U. S. Geological Survey, as part of the task of keeping American industries supplied with raw materials. The base maps of the present publication show the pre-war boundaries; but three special outline maps indicate by red over-print the erased and the new boundaries in Europe, Asia, and Africa. A fourth map shows world ocean trade routes and the fuel-oil stations established by the U. S. Shipping Board.

The seventy-two pages of text discuss the production, consumption, distribution, and statistics, for the world, of coal, petroleum, oil shale, natural gas, iron, manganese, chromium, nickel, tungsten, vanadium, molybdenum, copper, lead, zinc, platinum, gold, silver, phosphate, potash, nitrates, sulphur and pyrites, mercury, tin, antimony, arsenic, aluminum, graphite, magnesite, and mica, in the order given. The statistics tabulated and discussed in the text are translated into more impressive charts of the world, of each continent, and of the United States. On these charts each country's production of each mineral is shown by colored symbols placed over the respective countries. The production figures all relate to 1913, and express the percentage contribution by countries, to the world's mineral production. Special charts, however, give the results for 1918 in the United States, expressed as proportions of the total production of the United States. By comparing the North American chart for any mineral with the corresponding United States chart, one may get some idea of the change that took place during the intervening five years.

One of the distinctive features of the world maps is the parallel presentation of each country's consumption and production of minerals. This makes such charts striking summaries of each country's needs, and an index of the relative demands on each by the world. This atlas is an important aid in following and understanding the shifting trade of the world; and indispensable to the student of national and international political maneuvers. For, in the last analysis, a nation's foreign policy is determined by its home needs, and these are controlled in very large part by its resources of minerals, foods, and power. When the succeeding geologic parts of this atlas are issued, the whole will form an excellent graphic supplement to "Political and Commercial Geology," reviewed in these columns last year. C. A.

Mineral Resources of the United States, 1917. Part I—Metals. H. D. McCaskey. Cloth; 6 x 9; pp. 980. Published by the U. S. Geological Survey, Washington, D. C., and obtainable upon request.

All of the material in this book has previously been issued in separate form under the names of the various metals discussed, and most of these pamphlets have been noted on this page as they have appeared. These annual volumes are valuable only for reference, as they are too long delayed in publication to have any news interest; the information contained in this book, for example, is three or four years old. Even the separate papers were generally delayed two or three years.

Petroleum Annual, 1921. Handbook of the Petroleum Industry. Cloth; pp. 430; 9½ x 11¾. Published by the Independent Oil Men's Association, Chicago, Ill.

The issue contains lists of active and associate members of the organization, jobbers, refineries, and foreign dealers; traffic and transportation information; temperature, specific gravity, and tank capacity tables, and general information in the petroleum field. In addition, several papers read at the twelfth national convention of the Independent Oil Men's Association at Denver are presented. The book serves as a valuable guide to those interested in the commercial aspect of the petroleum industry, and is doubtless in big demand.

Technical Papers

Antimonial Gold Ore—Details of the treatment of antimonial gold ore at the Globe & Phoenix Gold Mine, in southern Rhodesia, are given in a three-page article in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa for January, 1921 (price 3s. 6d. from the Society at Johannesburg, South Africa). The ore contains about 76 per cent of silica and 0.73 per cent of antimony. After breaking and sorting, the ore is wet-crushed by stamps and passes over amalgamating plates to grinding pans. It then flows over canvas strakes to a classifier, which separates sand from slime. The sand is discharged to a dump; the slime to dams. Both products are allowed to oxidize by weathering, after which the sand is ground in tube mills in cyanide solution and treated by counter-current continuous decantation, while the slime is treated by the ordinary decantation method.

Explosives—Bulletin 198, forty-five pages, of the U. S. Bureau of Mines, is entitled "Regulation of Explosives in the United States," and deals especially with the administration of the explosives act of Oct. 6, 1917. It may be obtained free from the Bureau for a time, or for 10c. from the Superintendent of Documents, Washington, D. C.

Deep Mining—The *Bulletin* of the Institution of Mining and Metallurgy for February (No. 1 Finsbury Circus, London, E.C. 2, England) contains an article of nineteen pages outlining the scheme for working the City Deep Mine, in South Africa, at a depth of 7,000 ft. (Price of the paper, 1s. 6d.) The difficulties of mining at great depths are mentioned; particulars of shaft sinking at the City Deep are described, and the theory of ventilating deep and hot mines is discussed. Thirty-two pages of discussion of the paper are printed in the March issue of the *Bulletin*, which presumably may be obtained at the same price.

Assaying—U. S. Bureau of Mines *Reports of Investigations* No. 2,228, (obtainable upon request to the Bureau at Washington, D. C.), discusses the estimation of small quantities of gold, silver, and the platinum metals in ores and other material comparatively high in copper. The paper is supplementary to Technical Paper 270, issued by the Bureau, and deals with the application of the combination, or wet-and-dry, method.

War Industries—The War Industries Board, Bernard M. Baruch, chairman, has issued a report of 421 pages entitled "American Industry in the War," wherein are briefly described the industries over which the Government exercised control and the steps that were taken to regulate production and prices. Our readers will be particularly interested in pages 130 to 204, which are devoted to minerals, metals and chemical products, although much of general interest to the technical man is found throughout the book. The publication is obtainable on request to the War Industries Board, Washington, D. C.

Platinum—"The Detection and Estimation of Platinum in Ores" has just been issued as Technical Paper No. 270 by the U. S. Bureau of Mines, Washington, D. C., twenty-seven pages. It may be obtained on request to the Bureau for a limited time, or from the Superintendent of Documents, Washington, D. C., for 5c. The information given will be of value to all those who have occasion to assay for platinum. A bibliography of selected references on the subject is included.

Electrical Safety Code—The U. S. Bureau of Standards, Washington, D. C., has published a third edition of the "National Electrical Safety Code," 366 pages, obtainable on request. This booklet should be in the hands of all those interested in the design, erection, and operation of electrical machinery or wiring. Cloth-bound copies may be obtained from the Superintendent of Documents, Washington, D. C., for 40c.

Mineralogy—"The Future of Mineralogy in America" is the topic of a paper by E. H. Kraus, published in *Science*, March 11, 1921. (Garrison-on-Hudson, New York; price, 15c.) The development of the science is carefully traced.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

American Engineering Standards Committee Report

At the last meeting of the American Mining Congress, P. G. Agnew, Secretary of the American Engineering Standards Committee, said:

During or since the war, national engineering standardizing bodies have been formed in Austria, Belgium, Canada, France, Germany, Holland, Italy, Sweden, Switzerland, and the United States, and one is in process of formation in Japan. All of these are similar in form of organization and method of operation to the British Engineering Standards Association, which, organized in 1901, has been a most significant factor in the development of British industry.

Our own organization—the American Engineering Standards Committee—was organized in October, 1918, and has been actively at work for about 12 months. At the time the committee was organized there were more than a hundred American organizations actively engaged in standardization work, but there were no systematic, unified methods of co-operation.

Prior to Dec. 31, 1920, there had been approved by the committee "Tentative American Standard Specifications and Tests for Portland Cement," "Tentative American Standard Specifications for Fire Tests of Materials and Construction," and "American Standard Pipe Threads." Moreover, there had been submitted for approval by the committee the "National Electrical Code" as an "American Standard," and "Standard Test for Toughness of Rock," "Standard Method of Distillation of Bituminous Materials for Road Treatment," and "Standard Method of Sampling Coal," as "Tentative American Standards," with the "Safety Code for Head and Eye Protection" submitted for approval as "Recommended American Practice."

The committee itself is composed of forty-seven members representing seventeen bodies or groups of bodies, including six national engineering societies, five Government departments and thirteen national industrial associations. Its function is merely to see that each body or group concerned in a standard shall have opportunity to participate in its formulation, which is in the hands of a working committee, technically called a "sectional committee." Each sectional committee is organized by, and under the leadership of, one or more of the principal bodies interested, such bodies being known as "sponsors."

At a conference on Dec. 8, 1920, it was unanimously voted that a comprehensive program of safety codes should be undertaken, to be carried out under the auspices of the American Engineering Standards Committee. Active work is now in progress on twenty-four such codes. As is true of all work under the auspices of the American Engineering Standards Committee, such of the bodies as are interested in the particular code in question are represented.

Concerning standardization in the mining industry the report says:

At an informal conference held in Chicago on Aug. 30, 1920, of representatives of leading organizations interested in the standardization of mining equipment and practice, it was unanimously voted to recommend to the American Engineering Standards Committee that there should be organized a General Correlating Committee for Mining Standardization; that this committee should be made up of representatives of organizations which are now engaged in standardization work, or which might be expected to engage in it. In accordance with this recommendation such a committee has been formed with a nucleus of two representatives each from the American Mining Congress, the American Institute of Mining and Metallurgical Engineers, the U. S. Bureau of Mines, the Mining and Metallurgical Society of America, and the National Safety Council. It has held one meeting. Included in the work of the committee will be such matters as delimiting specific projects which might be most advantageously handled as units, and deciding the order in which the various projects should be taken up.

International standardization of zinc and zinc ores, including methods of sampling and analysis, had been proposed to the American Engineering Standards Committee by the Belgian Standardization Association. It was decided to co-operate with the Belgians in this work, and as the first step the Standards Committee invited the American Society for Testing Materials and the American Zinc Institute to be joint sponsors for American standardization. The American Society for Testing Materials specifications and methods of analysis for zinc, which are generally accepted throughout the industry, will form the starting point of further standardization, which will include standards for sheet zinc, etc. A "sectional committee" of fifteen members, five each representing producers, consumers and general interests (the latter including three Government representatives), will be organized in April.

Foreign Mining Committee Named

A committee on foreign mining has been formed by the Mining and Metallurgical Society of America as follows: C. K. Leith, chairman; Van. H. Manning, George Otis Smith, H. Foster Bain, Pope Yeatman, Sydney H. Ball, and A. C. Veatch.

Great Living American Engineers Picked by American Schools

The American Association of Engineers has been conducting an investigation to ascertain just who are the most highly esteemed engineers in the various branches of the profession. From questionnaires submitted to the deans of various engineering and scientific schools, the association's *Engineering News* leaflet No. 87, published at Chicago, Ill., on April 4, 1921, presents the following results. Only the names of those men receiving more than one vote are listed:

Civil Engineers	Votes
George W. Goethals	27
George P. Swain	23
John R. Freeman	21
J. A. L. Waddell	19
Daniel W. Mead	15
John F. Stevens	15
Allen Hazen	10
Rudolph Herring	10
Gen. W. M. Black	9
W. B. Parsons	9
F. V. Turneaure	9
Clemens Herschel	8
Gustav Lindenthal	8
John F. Wallace	8
Ralph Modjeski	7
Frederick H. Newell	6
J. Waldo Smith	6
W. H. Mulholland	5
A. P. Davis	2
	217

Mechanical Engineers	Votes
John A. Brashear	24
Orville Wright	18
Ambrose Swazey	18
W. F. Goss	17
Ira N. Hollis	15
M. E. Cooley	15
William F. Durand	13
D. S. Jacobus	12
R. W. Hunt	11
Julian Kennedy	10
James Hartness	7
Charles T. Main	6
G. Russ Richards	3
George A. Orrok	3
	169

Electrical Engineers	Votes
Charles P. Steinmetz	39
Elihu Thomson	29
Thomas A. Edison	28
Alexander Graham Bell	24
B. G. Lemme	15
Frank J. Sprague	13
Bion J. Arnold	11
John J. Carty	9
A. E. Kennelly	6
Charles F. Scott	4
	178

Mining Engineers	Votes
Herbert C. Hoover	32
John H. Hammond	29
J. E. Spurr	24
J. Parke Channing	18
Daniel C. Jackling	9
Pope Yeatman	6
L. D. Ricketts	5
Robert Peele	5
Horace V. Winchell	3
S. J. Jennings	2
	133

Chemical Engineers	Votes
Leo H. Baekeland	22
W. R. Whitney	22
F. G. Cottrell	19
E. G. Acheson	15
William H. Nichols	14
A. D. Little	8
William H. Walker	6
M. C. Whitaker	4
C. F. Chandler	4
G. A. Burrell	3
	117

America's Greatest Engineers

MEN YOU SHOULD KNOW ABOUT

James McEvoy, mining engineer of Toronto, is examining mineral properties in Mexico.

Kirby Thomas was examining gold properties in the Kirkland Lake district of Ontario last week.

Herbert H. Hodgson, of Morenci, Ariz., has been appointed a member of the Arizona State Industrial Commission.

Horace V. Winchell was in San Francisco, Cal., recently, when he spoke informally at a weekly lunch of the resident A. I. M. E. members.

Edwin James Collins, consulting mining engineer, of Duluth, Minn., has gone to Colorado and Wyoming on professional business.

Charles F. Sturtevant, mining engineer, of Salt Lake City, Utah, is examining mining property in Arizona on behalf of eastern interests.

H. O. Davidson, efficiency engineer for the Oliver Iron Mining Co., Gogebic district of Michigan, is visiting Pittsburgh, Pa., and other Eastern points.

A. W. Newberry, of 2 Rector St., New York City, is in Cleveland, Ohio, on professional business. He will return to New York about May 9.

James Hopkins, mining engineer, who has been working in the diamond fields of the Belgian Congo, was in New York City this week. His address is Ramey, Pa.

R. S. Archibald, engineer and geologist, of Negaunee, Mich., is in charge of explorations for the Palms-Book Land Co., in the Crystal Falls, Mich., district.

Charles N. Bell, **Walter L. Reid**, **Robert McF. Doble**, and **Frederick H. Dakin** have been appointed on the engineering staff of the Metals Exploration Co.

C. Herbert Poirier, mining engineer, of 63 Broadway, New York City, is at Porcupine, Ont., in connection with the transfer of the Bewick-Moreing holdings to the Goldale Mining Co.

Edmund A. Guggenheim, of Guggenheim Bros., New York City, has returned from a three-months' trip through Peru, Bolivia, and Chile, in the interest of the American Smelting & Refining Co.

S. H. Dolbear, who returned to San Francisco, Cal., recently, has gone to Ontario on professional business which will occupy several months. Mr. Dolbear also is establishing an office in New York City.

Hon. Key Pittman, U. S. Senator from Nevada, spoke before the New York Section of Mining and Metallurgical Society of America on April 28. He discussed the general silver situation, referring specially to conditions in the United States.

H. Foster Bain, acting director of U. S. Bureau of Mines, addressed the graduating class of the Michigan College of Mines, Houghton, Mich., at the class day exercises in the college gymnasium on April 14. He spoke on "Mining as a Business."

E. P. Mathewson, consulting metallurgist, of New York City, who has been in England on professional business for some weeks, went to Paris and Brussels on April 16. He returned to London on the 23d and will spend a few weeks there.

Frank Billings, of Cleveland, Ohio, president of the Tod-Stambaugh Co., has returned from his winter sojourn in the Bermudas. He visited some of the company's Lake Superior mines recently in the company of **J. S. Lutes**, manager of the mining department.

H. C. Cooke, of the Geological Survey of Canada, will act for **Dr. J. Austin Bancroft** at McGill University, Montreal, Que., next year. Prof. Bancroft has been granted a year's leave to serve as assistant general manager of the Granby Consolidated company's mines, Anyox, B. C.

George C. Martin, geologist with the division of Alaskan Mineral Resources, writes that he is still with the U. S. Geological Survey. The report that he had resigned is incorrect. **J. C. Martin**, of the section of foreign mineral resources, of the Survey, resigned on Jan. 31, last, to accept a position with the Standard Oil Co. of New Jersey.

Karl Baumgarten, mining engineer, of San Diego, Cal., who has served as examiner on the staff of the War Minerals Relief Commission at Washington, D. C., during the last year and a half, has been appointed a mining engineer on the staff of the U. S. Bureau of Mines. Mr. Baumgarten will be attached to the Mississippi Valley station of the bureau at St. Louis, Mo. He has fourteen years' experience in mining operations and examinations in the United States and in Mexico.

Mining and metallurgical engineers visiting New York City during the last two weeks also included: **L. D. Cooper**, Minneapolis, Minn.; **Juan Felix Brandes**, Boston, Mass.; **Roy H. Allen**, Parral, Mexico, and Cambridge, N. Y.; **Edwin Shapley**, San Francisco, Cal.; **F. J. Stannard**, M. I. M. M., 65 London Wall, London, England; **G. C. Burnham**, Boulder, Col.; **T. C. Merriman**, Hamden, Conn.; **W. Bjorkstedt**, Bayonne, N. J.; **Glenn V. B. Levings**, American Tripoli Co., Seneca, Mo.; **A. H. Wethy**, Paris, France; **Solomon Le Fevre**, Forest Glen, N. Y.; **Thomas F. Donnelly**, the Suffern Co., Valparaiso, Chile; **C. Leonard Ball**, Pulucayo, Bolivia; **Prof. Heinrich Ries**, Ithaca, N. Y.; **S. A. Taylor**, Pittsburgh, Pa.; **Guy R. Johnson**, Tamaqua, Pa.; **S. J. Gormly**, La Fundicion de Guyacan, Coquimbo, Chile; **Henry C. Carlisle**, Tonopah, Nev.; **J. Ward Williams**, formerly of Ojuela, Durango, Mexico; **Walter Hovey Hill**, Boise, Idaho.

OBITUARY

William Huggard, mining engineer, recently employed in mining operations in Montana, is reported to have committed suicide in a hotel at Tacoma, Wash., last week. He is survived by two brothers, A. M. Huggard, of Goldfield, Nev., and Edward Huggard, of Wexford, Ireland.

Lester Gray French, of White Plains, N. Y., assistant secretary of the American Society of Mechanical Engineers and the editor and manager of *Mechanical Engineering*, died at the French Hospital, New York City, on April 19, after an operation. Mr. French was a native of Keene, N. H., and was graduated in 1891 by the Massachusetts Institute of Technology. Six year later he became editor-in-chief of *Machinery*, and in 1908 assumed his last editorial position. He was among the earliest American writers on the steam turbine.

Edwin Jacobs died at Morenci, Ariz., on April 9, 1921, at the age of sixty-eight. He was a native of Australia, but had been in America for many years, and at the time of his death was employed in the stores accounting division at No. 6 concentrator of the Arizona Copper Co., Ltd., at Morenci. Mr. Jacobs was for several years editor of the *British Columbia Mining Record*, and was at one time secretary of the western branch of what was then the Canadian Mining Institute. During the years he lived in Australia he was engaged in the newspaper business, and also in banking and accounting. In British Columbia Mr. Jacobs had held various positions of trust and responsibility, and for a number of years was a correspondent of the *Engineering and Mining Journal* for that province.

George Frederick Wright, geologist, educator, and theist, died at Oberlin, Ohio, on April 20, in his eighty-third year. Professor Wright was born in Whitehall, N. Y., but early moved with his parents and other emigrants to what was then called the Northwestern Reserve, where they settled permanently. He was graduated by Oberlin College in 1859, and by Oberlin Theological Seminary in 1862. As an avocation, Professor Wright studied the geology of the glacial period so well illustrated in Ohio. His writings on this subject, notably "The Ice Age in North America" and "Man and the Glacial Period," were among the authorities of their day. He served as an assistant geologist on the staff of the U. S. Geological Survey under Powell from 1884 to 1892, and on the Pennsylvania State Geological Survey during 1881-82.

THE MINING NEWS

LEADING EVENTS

Tax Levies by Minnesota Cities and Villages Limited

Legislature's Action Follows Recent Defeat of Bill Providing Tax on Iron Ore Royalties

Taxing of iron-ore lands or profits accruing from them in Minnesota has received more than its share of attention at the present session of the State Legislature. As stated in the last issue the Occupational Tax Bill has become a law. On April 18 a bill to place a 5 per cent tax of royalties from iron ore was defeated in the Senate by a vote of 34 to 28. On the same date a bill to put a per-capita limitation on tax levies in Minnesota cities and villages was passed in the House by a vote of 80 to 44. On its introduction in the Senate, several days later, it passed by a vote of 42 to 17, and it is assured that the Governor will sign it.

The per-capita law will have a direct and vital bearing on the iron-ore companies in the state, as it limits the amount of taxation that can be collected by each separate city or village. The bill as finally passed allows $100 per capita for local purposes and $60 per capita for school purposes. These figures are in contrast to average figures from seventy-seven cities and villages, of $19.20 for local purposes and $12.69 for school purposes. As an example of how the limitation will work, the case of a small village might be cited where a sum of $557 per capita was expended last year.

American Dredging Company Gets Mexican Concession

Covers Nineteen-Year Period—Dredges Must Be Installed Within Nine Years

The American Gold Dredging Co. has secured from the Mexican government, through President Obregon, an exploration and exploitation concession giving the right to develop gold-placer deposits on the west coast of Mexico. The concession was secured by Ralph L. van der Naillen, and covers placer ground on the Yaqui, Fuerte, Mayo, and the Sinaloa rivers in the States of Sinaloa and Sonora. The concession is for a period of nineteen years. Three months are allowed for preliminary prospecting, one year is allowed in which to begin drilling, and four years are allowed to complete prospecting by drilling. The concession allows nine years to complete installation of dredges. Two parties for reconnaissance work have been organized and sent to Mexico. Placer operations in the region covered by the concession have been of a primitive nature.

WEEKLY RÉSUMÉ

The strike situation at Tonopah and Divide is unchanged from last week. A discovery of placer gold in the Johnnie district, four miles from the old Johnnie mine, has created much excitement locally. It is reported from San Francisco that the American Gold Dredging Co. has secured a nineteen-year concession from the Mexican government covering gold placer ground in Sinaloa and Sonora. At Salt Lake City it is reported that the Silver King Coalition has let a contract for a new steel mill building to replace the one recently lost by fire. At Denver the Radium Company of America has absorbed the Carnotite Products Co. of Boulder, Bulkeley Wells being president of the new consolidation. At Butte the Butte & Superior has cut copper ore in the 2,050 level of the Black Rock (zinc) mine. In Louisiana the Union Sulphur Co., in compromising its suit, has paid back taxes with interest amounting in all to $787,307 to Calcasieu Parish and the state. In Minnesota a bill providing a 5¼ per cent tax on iron ore royalties was defeated on April 18, since when a bill has been passed limiting the per-capita tax that may be levied by cities and villages in the state. In the Birmingham district of Alabama, iron ore production is at the lowest ebb in years. Calumet & Arizona has suspended copper production. New Cornelia has curtailed to 1,200,000 lb. of copper per month.

In Washington bills have been introduced proposing that a Division of Mines and Geology be created and that the annual assessment work on mining claims be suspended for the years 1921 and 1922. The mining committees of both House and Senate are ready. It is urged that the need for aiding development of Alaska is imperative to provide tonnage for the new Government railroad.

To Open Salt Mine in Texas at Raymondville

A salt mine will be opened on the King estate, west of Raymondville, in Cameron County, Texas. The salt deposit here covers many acres and is covered by only a light overburden of sand. The salt has been used locally for cattle for many years, but no attempt has been made before to market it. The salt forms the core of a coastal salt-dome formation.

Copper Companies Move Offices

Offices of the Inspiration Consolidated Copper Co., Greene Cananea Copper Co., Zonia Copper Co. and the Arizona Oil Co. will be situated at 25 Broadway (Cunard Building), New York, on and after May 1, 1921.

Radium Co. of Colorado Absorbs Carnotite Products Co.

Bulkeley Wells Heads Consolidation—Plants at Boulder and Denver Will Both Be Operated

A merger has been effected whereby the Carnotite Products Co., of Boulder, has been consolidated with the Radium Co. of Colorado, Ltd., whose plant and offices are situated at Denver. Operations will be continued under the name of the latter, as it has well-established trade relations with domestic as well as foreign radium markets. The officers of the new company are: Bulkeley Wells, president, and Warren F. Bleeker, vice-president, who, with K. L. Kithil, W. H. Schlesinger, R. W. Thorne, L. C. Schultz, H. C. Morgan, and A. H. Bunker, form the directorate.

By virtue of the consolidation the new company will rank as one of the largest producer of ores and radium products in the world. In addition to the production of radium the new corporation will manufacture ferro-alloys of vanadium, uranium, tungsten, and molybdenum, and its research laboratories will be constantly employed in the development of new rare-metal products. Operations, for a time at least, will be continued at both the Boulder and the Denver plants. The consolidated company is a large holder of vanadium and carnotite properties in western Colorado and eastern Utah.

The main offices of the Colorado Radium Co. are in Denver. The two upper floors of the plant contain completely equipped and modern laboratories for the manufacture of radium salts, and for all manner of research work in connection therewith. A testing laboratory equipped to make complete concentration tests, including fire and wet analysis, on practically any ore has been installed in the basement. The general offices are on the first floor. The main mine office of the company is at Naturita, Col., and sales offices are maintained in Chicago, New York, London, and Paris.

Although the greater part of the radium supply of the world is produced from Colorado ores the demand for radium is not by any means confined to the United States, as shipments of the element are made from Denver to Central America, South America, and all parts of Europe.

The Radium Company of Colorado, Inc., has been operating in Colorado for six years and has enjoyed a continuous and rapid growth. In taking over the Carnotite Products Co. it now becomes the largest manufacturer of radium salts in Colorado, if not in the world. The company employs more than 300 men and has a combined

monthly payroll of more than $60,000.

Several other radium companies are operating in the Colorado carnotite fields, and as there is a vast acreage of undeveloped carnotite territory the radium industry promises to hereafter figure largely in the mineral output of the state.

Southwestern Engineers Meet in Phoenix

L. M. Lawson, of El Paso, Elected President of Southwest District of A. A. E.

The second annual convention of the Southwest District of the American Association of Engineers was held in Phoenix, Ariz., April 15 and 16. The program consisted of business meetings, a banquet, and a smoker. The papers presented were: "The Engineer, Past, Present, and Future," by Dean R. W. Goddard, State College of New Mexico; "Some Comments on the Arizona Engineers Registration Bill," by Dean G. M. Butler, president of the Southwest District, A. A. E.; "Initial Wear and Adjustment," by W. O. Witherspoon, of Bisbee; "Accomplishment and Plans of A. A. E.," by C. E. Drayer, National Secretary, A. A. E., Chicago; "Public Service the A. A. E. Can and Should Render," by C. J. Rofelty, Globe, and "Irrigation Development in the Southwest," by L. M. Lawson, El Paso.

The following officers were elected: L. M. Lawson, El Paso, president; Dean R. W. Goddard, A. and M. College, New Mexico, first vice-president; L. B. Hitchcock, city engineer of Phoenix, second vice-president; E. P. Rankin, Jr., El Paso, third vice-president; Dean D. S. Robbins, A. and M. College, New Mexico, treasurer. Other directors elected were: J. C. Gilbert, of Globe; H. F. Robinson, of New Mexico, and C. W. Bagley, of Texas.

Attempt To Secure Control of Hecla Company Fails

Unusual interest attached to the annual meeting of the Hecla mining company, owner of the famous lead-silver mine in the Cœur d'Alene district, which was held in Spokane on April 12, due to the fact that it was known that an attempt would be made to control the meeting in the interest of the Days and elect E. R. Day, manager of the Hercules, president. It appears that Mrs. Sarah E. Smith, of Chicago, widow of the late James R. Smith, who was president of Hecla at the time of his death, joined with Mr. Day in an effort to get control. Although a great effort was made to secure proxies, when the show-down came it was disclosed that the combination controlled only 160,000 votes out of a total of 1,000,000. Of this number Mrs. Smith, who is the largest individual stockholder in the company, owned 93,000 shares and Mr. Day 20,000, leaving only 47,000 votes as the net result of the campaign for proxies. The old board of directors was re-elected.

Tonopah and Divide Strike Situation Unchanged

Many Employees Would Have Accepted 50-Cent Cut, It Is Reported; 75-Cent Reduction Thought Too Much

The strike situation at Tonopah and Divide is unchanged. The only companies operating normally in the Tonopah district are the West End, Halifax, and Cash Boy. In Divide several small companies have resumed operations paying the old wage scale or contracting. Neither side appears to be seeking a settlement.

The sentiment among some of the workmen is that a 50c. reduction would have been acceptable to a majority of the employees, and in fact has been expected since Feb. 8, the date of expiration of the last agreement between operators and employees. The principal objection appears to be over the extra 25c. and over the manner in which the reduction was announced—by simply posting notices only five days in advance, with no opportunity for conference between operators and men. Comparing the wages in this district with those in other districts would lead one to the conclusion that the reduction is likely to be sustained.

Up to April 16 all mines and mills in the districts were operating to capacity, development and production being normal, with no new discoveries of importance reported. West End profits for March are reported as $56,839.67, from 5,824 tons of West End mine ore and 531 tons of Jim Butler lease ore.

The visit of an engineer representing eastern controlling interests in the Buckeye Belmont mine in Tonopah has given rise to rumors that this property is to be reopened in the near future. The property is advantageously situated, adjoining the Belmont, Rescue, and Halifax mines. Development to date consists of a 1,200-ft. vertical shaft, with about 3,000 ft. of laterals on the 900 and 1,200 levels.

Cut Pay of Workers on Ore Docks On Lake Superior

A meeting of representatives of the International Longshoremen's Union and the railroad companies owning ore docks on Lake Superior was held recently at Ashland, Wis., and the wage scale for 1921 adjusted. The men accepted a reduction in rate of pay under formal protest, which will be carried up to the wage board for a final decision. If the wage board decides that the reduction was unwarranted the workers will get the rate as fixed by the board. The new scale calls for 55½c. an hour for both the day and night shifts. Last year's rate was 55c. for day labor and 66c. for night work. The office force will accept a reduction of 10 per cent in pay. The meeting was harmonious, and it is not believed that there will be any labor troubles on the docks this year. The carriers represented at the meeting were: Chicago Northwestern, Soo Line, Lake Superior & Ishpeming, and C. M. & St. P.

Chestatee Company Reorganized As Piedmont Corporation

New Owners Talk of Building Sulphuric Acid Plant

It is reported that the property of the Chestatee Pyrite & Chemical Corporation, at Chestatee, Ga., has been reorganized under the name of the Piedmont Corporation. No bonds have been issued. It is planned to build a sulphuric acid plant at the mine, with a capacity of 100,000 tons of acid per year; also a stone-crushing plant of 1,000 tons daily capacity, for supplying stone to the state highway. It is said that the Piedmont Corporation has purchased the property outright.

Silver King Coalition Contracts for New Steel Mill Building

Will Replace One Lost by Fire—To Pay 15c. Dividend From Money Saved for Possible Damages

A contract for the erection of a steel mill building for the Silver King Coalition Mines Co., at Park City, Utah, to take the place of that recently destroyed by fire, has been awarded to James Burk & Co., of Salt Lake City. The cost is to be between $45,000 and $50,000, and work will be started upon the arrival of the material, which is expected in about forty days. The mill building is to have a length of 300 ft. along the slope of the hill; the upper half, which will house the crusher plant, will be 40 ft. wide, and the lower half 80 ft.

A separate building is to be erected at the lower end of the mill for the boiler plant and the concentrates dewatering equipment. This will be 125 x 18 ft. There will be two ore bins at the upper end of a combined capacity of 3,000 to 4,000 tons; the larger one, 100 ft. long x 20 ft. wide x 20 ft. high, will hold the coarse ore, and a smaller one, 40 ft. long x 20 ft. wide x 20 ft. high, will be used for the crushed ore. There are said to be excellent opportunities for obtaining slightly used mill machinery suitable for the new plant, and these will be investigated while the mill building is in process of construction. It is thought that it will be possible to build the mill at a considerably lower cost than could have been done a year ago. Concentration and flotation will be used.

The company will pay a dividend of 15c. a share, or $182,415, on May 1 from money accumulated to meet the possible contingency of losing in the litigation with the adjoining Conkling Mining Co. and having to pay damages. The Coalition won the suit.

Union Sulphur Co. Pays Back Taxes

The Union Sulphur Co., operating at Sulphur Calcasieu Parish, La., has paid back taxes and interest due amounting to $783,307. Of this amount the parish will receive $632,212 and the state the remainder. This does not include $36,000 in fees due the attorneys of the parish.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

McFadden Gold Bonus Bill Revised

Period Reduced From Five to Three Years—Exporters of Articles Containing Gold Exempt

In a revised gold bonus bill, Representative McFadden, the chairman of the House Banking and Currency Committee, reduced the period covered from five to three years. The Secretary of the Treasury is empowered to terminate the act at any time on three months' notice in the event economic conditions return to normal. Exporters of articles containing gold are exempt from the premium of 50c. per pennyweight.

"The bill provides revenue," said Mr. McFadden, "from an excise of 50c. per pennyweight of fine gold contained in manufactured articles, to be collected at the time of sale, and for a premium of 50c. per pennyweight to be paid to the producers of newly mined gold in the United States and its possessions. The Government is fully protected under the provisions of the bill from the presentation of other than newly mined gold to receive the premium. The bill differs from H.R. 13,201 introduced by me in the last Congress, in that the period has been lessened from five to three years, and that the Secretary of the Treasury is granted full authority to terminate entirely the provisions of the act on three months' notice in the event of a return to normal economic conditions prior to the expiration of the same. Exporters of articles containing gold have been exempted, as they were from the payment of the luxury tax, in order not to interfere with foreign competition. Revenue will be derived on all gold articles of foreign manufacture sold in this country."

In reviewing the history of this legislation Mr. McFadden stated:

"Extensive hearings were conducted in the last Congress on this bill, and it was reported favorably by the subcommittee of the Ways and Means Committee before adjournment. Increases in freight and power rates have more than offset any declines in wages and materials consumed in gold mining. Because of the emergency confronting the gold mining industry, the enactment of this bill should be expedited."

Division of Mines and Geology Again Proposed

Senator Pittman, of Nevada, has reintroduced the bill proposed at the last Congress by Senator Henderson, which provides for the creation of a division of mines and geology in the Department of the Interior. The idea is to fuse into one super-bureau, to be known as a division of the department, all of the activities now centering in the Geological Survey and the Bureau of Mines.

Suspension of Assessment Work Proposed for 1921, 1922

New Mexico Senator Introduces Bill—Chance of Passage Held To Be Poor

Senator Holm O. Bursum, the new Senator from New Mexico, has introduced a resolution providing for the suspension of annual assessment work on mining claims during the calendar years of 1921 and 1922.

When the time for completing the 1920 assessment work was extended until July, 1921, it was predicted that an effort would be made to enact legislation to cancel entirely the obligation of that and subsequent years. It is evident that the prediction will be fulfilled, as Senator Bursum intends to push his bill, in which action he will have the support of a number of members of the Senate and of the House of Representatives. The chance for the success of the measure is not regarded as particularly good.

War Mineral Awards

Awards totaling $47,901.77 were recommended by the War Minerals Relief Commission during the week ended April 9. The Blue Mountain Chrome Co. was awarded $16,296.43. This is 51 per cent of the amount claimed. In the chrome claim of the Bellefonte Lime & Stone Co., an award of $20,048.77 was recommended. This was 47 per cent of the amount claimed. Additional evidence made possible awards in the following cases: E. A. Garrison, $470.25; Powderhorn Mines Co., $1,498.64; I. Lanski & Son, $7,440.44. A further award of $272.74 was made in the claim of William A. Blanton, who previously had received an award of $400. An additional award of $1,874.50 was made to the Morgan-Leitcher Co. A previous award of $5,060.35 to the Morgan-Leitcher Co. had been made.

Recovery of Vanadium Oxide Object of Study Proposed for Government

Research looking to the recovery of vanadium oxide (V_2O_5) from Western phosphates and from coal, hydrocarbon shales, and natural asphalts has been suggested as a proper activity for the Federal Government. This material, which is used in such great quantities in the making of steel, occurs extensively in the United States. It is believed that its economical recovery presents no obstacle greater than many that have been surmounted by American scientists. Vanadium oxide occurs in the ashes of many coals. In certain coals, it is stated, it forms as high as 38 per cent of the ash.

Mining Committees of House And Senate Ready

Nearly All New Members of Former Familiar With Mining Conditions

After some delay in organization, the committees of the Senate and of the House of Representatives are now ready to function. The majority members of the Committee on Mines and Mining of the Senate are as follows: Poindexter, Washington (chairman); Sutherland, West Virginia; Newberry, Michigan; Oddie, Nevada; Nicholson, Colorado, and Norbeck, South Dakota. The minority members are Walsh, Montana; Ashurst, Arizona, and Pittman, Nevada.

The majority members of the House Committee on Mines and Mining are: Rhodes, Missouri (chairman); Echols, West Virginia; Robsion, Kentucky; Brooks, Illinois; Luhring, Indiana; Connell, Pennsylvania; Arentz, Nevada; Williamson, South Dakota; Colton, Utah, and Sutherland, Alaska. The minority members of the committee are: Wingo, Arkansas; Rainey, Alabama; Favrot, Louisiana; Swank, Oklahoma, and Meyer London, of New York.

The personnel of each of the committees has been changed decidedly. Senators Poindexter, Sutherland, Newberry, Walsh, and Ashurst saw service on the Senate committee at the last session. The additions to the committee, however, are all men with an intimate knowledge of the mining industry.

The only members of the new House committee who saw service during the last Congress are Rhodes, Echols, Robsion, Brooks, Luhring, and Wingo. Nearly all the new members bring to it an intimate knowledge of the mining industry. Nevada, South Dakota, Utah, Alaska, and Pennsylvania, political subdivisions in which mining is an important industry, now have representation on the committee. Alabama, with its important coal, iron, and graphite industries, is represented; also Louisiana, with its sulphur, salt, and other nonmetallic mineral industries. The petroleum industry is recognized by the appointment to the committee of Swank, of Oklahoma.

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended April 23 totaled 1,040,651 fine ounces. This brings the total purchases under the Pittman law to 48,922,107 fine ounces.

Sale of 25,550 tons of steel billets is to be undertaken by the War Department. Bids were received until 10 a.m. April 29.

Need for Aiding Alaska Urgent, Says Senator New

Must Abandon Conservation Policy, Says Willis—Tonnage Needed for Government Railroad

That something immediate and certain to be effective must be done to stimulate the development of Alaska is the opinion of Senator Harry S. New, of Indiana, the chairman of the Committee on Territories. Several members of the committee expect to make a trip to Alaska this summer, if business before the Senate will permit, so as to bring back a report from the legislators' standpoint as to what the territory needs to stimulate its development.

Senator New says that no new country can be developed rapidly in the face of numerous restrictions. In Alaska, where there are unusual obstacles as compared with more favorably situated areas, Senator New is convinced that unusual opportunities must be offered to those who pioneer the country. He says that it is obvious that they will not endure the hardships and the risks when they know in advance that their chances are no better than in the settled communities.

Senator Willis, of Ohio, another member of the committee, declares that we must abandon the conservation policy which permits the resources of Alaska to be looked at, but does not allow the prospective developer to go much further. He wants to see the coal, metal, and water-power resources of Alaska turned loose, so that the territory may thrive. Restrictions which may be entirely reasonable and proper in the United States itself are not necessarily best for Alaska, he declares.

That Alaska is giving the Administration some concern may be judged from the fact that the President himself is so anxious to make a trip to that territory. Mr. Harding, during his service in the Senate, was an active member of the Committee on Territories, and is fully conversant with Alaska's problems. With the Alaska Railroad nearing completion, it is recognized that it is the duty of the Federal Government, as its owner, to do all in its power to stimulate Alaskan enterprises, so that the operation of the railroad will not be a heavy item of expense. Had a private corporation undertaken the construction of this railroad, it is pointed out that a considerable percentage of the capital would have been employed for tonnage-getting purposes from the initiation of the project. For the last year there has been much talk of special activities looking to the securing of tonnage for the railroad, but no systematized effort has as yet been undertaken.

The U. S. Geological Survey is of the opinion that the most potent influence to draw capital to Alaska would be the establishment of the fact that it has formations favorable to the occurrence of oil. For that reason, the emphasis of the Survey's work there this summer will be placed on oil geology.

The principal work will be done on the west shore of Cook Inlet and in the Cold Bay region. Geological research in the metalliferous areas will not be discontinued, however. Practically all of the work will be done in territory tributary to the railroad. The regions to be examined geologically include the Forty-mile Tanana section between the Tanana River and the Canadian boundary, the Koyukuk gold placer region, and the silver lodes near Ruby.

NEWS BY MINING DISTRICTS

CANADA

O'Brien Denied Injunction Against British America Nickel Corporation—Hollinger Running at Full Capacity

Ontario

Sudbury—The application by M. J. O'Brien for an injunction restraining the British America Nickel Corporation from carrying into effect the proposed scheme for financial reorganization has been dismissed by the court at Toronto. Judge Middleton, in pronouncing judgment, stated that if the corporation carried out its plans it would do so at its own peril, as if Mr. O'Brien, as a minority bondholder, sustained any injury as a result of such action he would be able to seek redress in the courts.

Porcupine — The Hollinger Consolidated is working at full capacity. The last battery of stamps went into operation on April 19 and the plant is treating 3,300 tons of ore every twenty-four hours, employing approximately 1,450 men and eighty-two machines.

The Crown Trust Co., of Montreal, has taken up $100,000 in mortgage bonds of the North Crown, which has placed the company in funds for the resumption of operations about May 1.

The Goldale Mining Co., which recently took over the Bewick-Moreing group of claims on the east side of Pearl Lake, has a small crew of men at work.

Port Arthur — Active preparations are being made for the resumption of work at the old Silver Islet mine. A gang of men are at work repairing the buildings and the work of pumping out the mine will be begun soon.

Cobalt—A temporary headframe has been erected at the Meyer's shaft of the Nipissing to take the place of the one destroyed by fire and will be ready for use in a day or two.

Yukon Territory

Dawson—A news dispatch from Dawson announces that a rich strike of silver ore has been made at Keno Hill, 160 miles east of Dawson. The strike is reported to have been made in the No. 9 tunnel on the Rico claim, owned by the Yukon Gold Mining Co. The ore is high-grade argentiferous galena. The company has 2,500 tons of ore at Mayo ready for shipment on the first steamers. A number of claims in the vicinity have been optioned recently.

ALASKA

Willow Creek Gold Mine Resumes

Seattle—Milo Kelly, general manager of the Willow Creek-Alaska Gold Mining Co., who has been spending the winter in Seattle assembling supplies and making plans for the coming season, sailed recently to begin work at the property. Last season a cyanide mill was built and the company intends to enlarge this so that it will have a capacity of 200 tons. Power-plant machinery will be installed.

ARIZONA

United Verde Extension May Take Over Jerome Verde Holdings

Jerome—Jerome is nearly at a standstill, with little more than an upkeep force left in its main mines and with the U. V. smelter, at Clarkdale, and the Extension smelter, at Clemenceau, merely cleaning up the ore bins. The latter has a large quantity of ore on hand, but will operate only until the reverberatory roof caves in. United Verde will retain 240 men in the mine and 160 at Clarkdale. Extension recently has had a force of 450 and is expected to retain not over 100. None but married men are being retained, the American Legion specifically waiving any priorities its members may have acquired by war service.

At 110 ft. below the 320-ft. tunnel level, the Shea has a 4-ft. ore shoot sampling $18 in silver and $4 gold, with some copper.

Stockholders of the Jerome Verde Copper Co. will meet in Phoenix May 5 to pass upon an offer of sale of the company's property to the Jerome Verde Development Co. to be a subsidiary of the United Verde Extension Co. The new corporation is to be organized under the laws of New Jersey, with capital stock of $1,500,000, in 50c. shares. It is proposed to buy the property and assets of the Jerome Verde for $420,000, in cash or for exchange for the new company's stock on the basis of ten shares for one. The

United Verde Extension Co. will take an option to purchase 628,078 shares of the new stock for $454,039. Jerome Verde has 5,230,000 shares outstanding. An offer of $500,000 in bonds has failed to find purchasers, and there is now outstanding a mortgage note of $72,000, given to pay personal injury judgments of $27,000 and taxes and running expense. Though recent reports as to operations on the Columbia 1,100 level appear encouraging, most of the stockholders favor the exchange. The transaction would give the Extension an immensely increased acreage.

Globe—The International Smelting Co.'s works at Miami are cleaning up for total suspension of operations, and the Old Dominion smelter has made its last bar. The Miami concentrator at Miami is still being operated, the only copper mill still active in Arizona, but there is speculation whether it will long continue to pile concentrates. Superior & Boston announced a cut of 40 per cent in the number of employees.

It is hoped locally that enough silver ore can be produced to warrant operation of a lead-silver stack in the El Paso smelter, where such smelting was stopped March 19 for lack of ore. To do this it is believed freight rates will have to be reduced to pre-war figures. Prospecting has become active in the McMillen, Richmond Basin, upper Miami and other sections that were silver producers many years ago.

A serious condition of drought prevents better development of much Arizona placer ground on which at least wages could be made by hundreds of miners now idle. A brisk demand is noted for dry washers.

A committee of residents of Gila County, headed by the county engineer, Julius Milton, recently waited on Governor Campbell, urging employment on state roads in the county for miners who are out of work in the district. Greenlee County will make a similar appeal through the Clifton Chamber of Commerce in behalf of those out of work in the Clifton-Morenci districts.

Ajo—Owing to the difficulty of marketing securities, there is no prospect of early construction of the railroad planned from Ajo to the Gulf of California. The projected route was inspected lately by officials of the El Paso & Southwestern system, including Arthur James, Walter Douglas, and President T. M. Schumacher, escorted by J. C. Greenway, general manager of the Calumet & Arizona and New Cornelia mining companies. At present active efforts are being made to develop water along the 100-mile length of the proposed road. A well bored several miles from the sea coast was found salty. A harbor will have to be created at the terminus, Rocky Point, with the provision of at least one 1,500-ft. breakwater. As indicated by the name, rock for the breakwater is at hand, a great advantage, for the coast generally is low and sandy.

Douglas—The present stoppage of operations by the Copper Queen branch of the Phelps Dodge Corporation is stated to be the first for forty years, save for brief periods for needed repairs. There still remain in employment of the company about 1,100 men in the Warren district and several hundred here, though G. H. Dowell, general manager, states that there is to be further reduction within a few weeks. Men laid off are to be given full seniority and pension rights when reinstated, provided return is within thirty days from time of notification. Financial assistance will be given men who remain or to their families and a liberal policy will be in effect covering payments on homes.

Calumet & Arizona will retain 575 men in its mines below Bisbee and will mine and stock about 15,000 tons of ore a month. At the Douglas smelter the boiler and power plants will be continued in operation till the ore beds have been filled with crushed material. Much repair work will be done at the smelter. In the mines, the Junction and Campbell shafts are to be completed and exploration work is to be prosecuted from the No. 3 Cole shaft. At Ajo, the New Cornelia force will be reduced to 300 men, from the present strength of 522.

Closing of the local smelting plants has been a serious matter to small shipping mines in Arizona and Sonora. Such properties as the Stargo, at Morenci, and El Tigre, south of Douglas, hope for continuance of operation of at least one silver stack at El Paso. Efforts are being made to secure, mainly from Globe, silver ore enough for running the small smelter at Benson, though a new stack might have to be added if the present copper handling equipment could not be satisfactorily modified. Facilities for concentrating silver ores are lacking in Globe.

Tombstone—The National Metals Recovery Co. expects to start its mill soon. J. W. Stockham will be in charge.

Patagonia—On the bottom level from the new vertical shaft of the Hardshell Mining Co. the crosscut has intersected a prominent vein 200 ft. from the shaft. The vein is 30 ft. wide, and is believed to be the eastern extension of the Hardshell vein. Streaks of shipping ore assay 4 oz. silver, 37 per cent lead and 1.8 per cent copper. At a distance of 230 ft. the crosscut encountered a heavy flow of water, estimated at 1,000 gal. per minute, which was more than the present steam pumping equipment could handle, so development work has been temporarily discontinued, pending the installation of electric pumping equipment designed to handle the flow. It is estimated that the new electrical equipment under consideration will cost about $20,000. The company's Bender properties are being developed under lease. The main tunnel has opened a mineralized zone containing stringers and irregular bunches of silver-lead ore. The veins vary in width from 1 in. to 2 ft. Much of the material will average about 30 oz. silver per ton, and sorted ore assays as high as 5 oz. gold, 1,000 oz. silver, and 64 per cent lead. A trial shipment of five tons of high-grade ore has been made. The strike is creating considerable excitement in the district, and may develop into a shoot of more than ordinary interest. Howard K. Welch is general manager and Murray L. Sanders is consulting engineer.

COLORADO

Buffalo Sulphur Co. Operating Steadily at Creede—Royal Tiger Mill Almost 60 Per Cent Complete

Aspen—Development work in the tunnel of the Hope Mining & Milling Co. confirms the promise of a rich discovery of silver ore recently made. The operators are composed principally of Aspen people, who leased a long-abandoned tunnel, which they extended several hundred feet to connect with a vein, famous in early days for a surface product of extremely rich silver ores. The company states that "the lower portion of the vein averages 1 ft. in width and the upper section from 6 to 12 in. A cross section assay of the lower portion of the vein gives 174 oz. in silver and the upper portion gives .047 oz. These assays are fairly an average of the vein." Drifting on the ore shoot has progressed about 25 ft. Owing to the heavy snows in the Aspen district and the impassable roads at this season shipments will not start until about May 15.

Creede—This old silver producing district is rapidly coming to the fore in sulphur output. For a year or more the Buffalo Sulphur Co. has been developing its property on Sulphur Creek, about 20 miles southwest of Creede. In addition to equipping the mine the company constructed an extraction plant at the mine which converts the ore (a combination of aluminum silica and sulphur) into a crude product, which is shipped to the refining plant at Creede to be converted into commercial sulphur.

Operations at the mine in the last year disclosed a blanket vein from which the overburden was removed, showing a 100-ft. face of sulphur combined with aluminum silica, averaging approximately 60 per cent sulphur. Exploration work with a diamond drill further back on the mountain side indicates extensive deposits of the mineral, insuring many years' supply for the plant. Diamond drilling will be continued, together with an extensive plan of development.

The extraction plant at the mine has a capacity of approximately 125 tons of ore every twenty-four hours, with a crude sulphur output of from fifty to seventy tons. The crude sulphur is conveyed to the refinery at Creede by a Holt tractor train and is then converted into rubber sulphur, brimstone, ground sulphur, flour sulphur, and other products. The sulphur is said to be of the highest grade, and entirely free from arsenic, selenium, or other deleterious elements.

Breckenridge — The Royal Tiger Mines Co., which has been operating

in this district for the last two years, is carrying on an extensive plan of development. This company has increased its holdings to upward of 2,000 acres, most of which is highly mineralized.

Operations were first carried on on the Tiger group, near which the town of Tiger sprung up, and, as the operations of the company expanded, a post office and school district were established. In connection with development work carried on by this company a pilot mill was constructed, in which was worked out the problem of ore treatment. A new 400-ton mill is almost 60 per cent completed. A 100-ton unit will be ready to treat ore about June 1. Development work this year includes the sinking of a 1,000-ft. shaft on the South Tiger properties, sinking from the 850 level of the Tiger group to 1,000 ft. and the extension of the I.X.L. tunnel 700 ft. to the Cashier group.

UTAH

New Shipping Ore Opened in Tintic Standard—Tintic Milling Shipping Silver Bullion Direct to Mint

Eureka—A strike of interest is reported at the Tintic Standard, where a face of shipping ore has been opened in a drift from the No. 1 shaft, which is further to the south than any other workings, ore having first been opened 1,500 ft. north of this shaft. The face of the new strike is out 800 ft. to the northeast of the shaft, and the drift is cutting across the ore channel diagonally. The No. 1 shaft is 1,700 ft. southwest of the No. 2 shaft, which is at present producing most of the ore. A shipment of 10,000 oz. of silver bullion was made from the new mill to the United States mint at Denver the week ended April 16.

Silver City—The Tintic Milling is shipping silver bullion to the mint direct and separating the copper and silver bullion at its mill. Shipments in a period of a few weeks will amount to about 77,000 oz. of silver bullion. There was shipped 22,000 oz. the week ended April 16, 35,000 oz. the week preceding, and 20,000 oz. is going out soon. The company is preparing to reopen the Swansea, which has a considerable tonnage of mill ore at or near the 500 level. This mine produced high-grade ore in the past, and operations were halted by the coming in of water. This does not affect the concentrating ore, which is found above water level.

Oakley (in Idaho)—The Vipont Silver Mining Co. in Utah near the Idaho line has completed a power line from Oakley, Idaho, 21 miles away. The mill has been running by electricity for about two weeks, and it is expected to have power at the mine very shortly. This will mean a considerable economy in operation, as the company has had to haul oil for the Diesel engines over bad roads and steep grades. Both mine and mill have been operating throughout most of the winter.

IDAHO

Bunker Hill Smelter and Hecla Mine To Cut Wages

Wallace—Several months ago the wages of miners in the Cœur d'Alene district were reduced from the wartime rate of $5.75 per day to $4.75, and muckers, who had been receiving the same pay as miners, were cut $1.25 to $4.50 per day. Corresponding reductions were made at the Bunker Hill smelter. A further reduction in wages is now necessary, according to announcements recently made by Frank M. Smith, director of the Bunker Hill smelter, and James F. McCarthy, president of the Hecla Mining Co. Mr. Smith described the position of the smelter thus: "In selling our lead in the East in competition with the Montana lead smelters, we are at a decided disadvantage owing to the much lower wage scales paid by those smelters. To keep running at the Bunker Hill and successfully compete with these other plants, it will undoubtedly be necessary to make a reduction in wages in the near future. I have no doubt that our employees would much prefer to accept lower wages rather than to see the plant shut down. Ample notice will be given later as to what policy we will pursue."

In a statement mailed to stockholders Ben L. Collins, manager of the Western Union Mining Co., states that from Nov. 19, when the first shipment was made from the property, to March 11 the lessees have shipped eleven carloads of ore, aggregating 872,099 lb., for which the net smelter returns were $26,103.83. Since the last date four cars have been shipped, for which returns had not been received. The company receives a royalty of 25 per cent, and assumes no expense whatever. The lease expires in August, when operations will be taken over by the company. The average mineral content of Western Union ore as shipped was 43.58 oz. of silver to the ton and 52.58 per cent lead.

As a result of the litigation between the Star Mining Co. and the Federal Mining & Smelting Co., which resulted in favor of the former, the Federal company is required to pay the Star for all ore removed from the ground of the latter through the operation of the Morning mine. Fixing the amount of the claim is a complicated task, and has now occupied the attention of Rush J. White, chief engineer for the Star, for several months. He is now receiving assistance from W. J. Hall, formerly assistant general manager of the Federal, and Fred W. Calloway, of San Francisco, a mining engineer formerly connected with the Bunker Hill & Sullivan. It is understood that the records of the Federal have been placed at the disposal of the Star, and it is expected that an agreement on the amount of the claim will be reached without further action in court.

Mullan — The Independence Lead Mines Co. is planning to resume development by May 1. The lower tunnel has recently been retimbered. Considerable low-grade ore has been exposed in two upper tunnels, and an effort will be renewed to locate it in the lower. The Independence is favorably situated between the Morning and Hunter mines. The property was one time controlled by the late August Heinze. W. M. Bacon, formerly manager of the Stewart Mining Co., is the chief stockholder. W. E. Cullen, of Spokane, is secretary-treasurer.

Bonners Ferry—Sluicing operations of Idaho Gold & Ruby have been commenced on property owned near Leonia, on line of Great Northern railway. Ten years have elapsed since a commencement was made on operations and large expenditures have been made in that time to bring the property to a producing stage. Outcome of the results of sluicing operations is awaited with much interest.

MONTANA

Butte & Superior Cuts Copper on 2,050 Level in Black Rock Mine

Butte—A body of copper ore has been cut on the 2,050 level of Butte & Superior's Black Rock mine. Whether the new deposit is in the Rainbow vein, the zinc fissure of the Black Rock, or in a so-called "northwester" vein, has not yet been determined, because of the faulted condition of the ground. If it should prove to be the Rainbow it will tend to fulfill predictions made in engineering circles years ago, that the noted zinc bodies of the Black Rock would give way to copper with depth. This copper shoot shows an ore width of 12 ft., with chalcopyrite and copper glance sprinkled through the face. This copper ore is going to the stock pile and will be milled when milling operations are resumed.

Last week the Main Range shaft of the Tuolumne Copper Mining Co. reached a depth of 1,600 ft., the immediate objective, and following the completion of a 25-ft. sump and cutting a station, crosscutting for the Spread Delight vein, estimated to be about 300 ft. south of the shaft, will be started.

The 2,700 level of the Colorado mine of the Davis-Daly company was connected last week with the recently completed air shaft by means of a raise, and a direct air current established, lowering the temperature on this level more than 20 deg. and bringing the working conditions to a point of comfort excelled by none of the deeper mines in the district. The Colorado property now is independent of any of the neighboring companies for ventilation.

Development of Anaconda's phosphate deposits near Soda Springs, Idaho, is continuing, despite the suspension of the production of metal output. The experimental phosphate plant at the Washoe works will continue operations for several months, it was announced, although the rest of the works has been closed.

The Norwich vein has been cut on the 400 level of the Plutus, showing about

15 ft. of well-mineralized manganese material, with silver ore in evidence. Crosscutting is continuing, as the ore in evidence on the upper levels lies on the wall opposite from the one first cut. A 500-gal. electrically operated pump was installed recently on the 400 level.

Lessees at the Butte-New England are making regular shipments from the Hesperus vein.

Bullion production for March by the Barnes-King was $30,938.32, an increase of $8,453.25 over that for February. The recently reported ore development on the lower level of the Shannon mine failed to hold up, according to the company's monthly statement, which said that after continuing for 30 ft. with the grade good in the 605 drift the values dropped off. From the North Moccasin lessees the company received $1,125 during the month. Shaft sinking at the Black Hawk claim has reached a depth of 103 ft.

Jardine—The Butte-Jardine Metals Mine Co. will continue work at the Champion mine, it is announced. Installation of a filter in the new 150-ton flotation concentrator has been decided upon to facilitate the drying of concentrates. When this is in place, it is expected that regular shipments will be begun. High-grade ore is reported in the main tunnel.

Dillon—Development plans of the Silver Spray provide for driving a tunnel instead of a shaft. High-grade copper ore has been opened near the surface and the ground has been prospected to a depth of 80 ft.

Neihart—The Montana Mining Association has advised that it has been informed of an important silver ore development in properties of the Block P. Company, which is operating the Wright & Edwards and the old Barker group of claims. Ore is being hauled 14 miles by auto truck.

WASHINGTON

Index — The Sunset copper mine, which suspended operations Jan. 1, now has a small crew employed on exploration work.

CALIFORNIA

Mother Lode Companies Cut Wages—Dredge Men Study Operations on Mokelumne and Calaveras Rivers

San Francisco—The San Francisco Section of the A. I. M. E. held its regular monthly meeting on April 26, G. B. Rosenblatt presenting a paper on "Mechanical Haulage for Metal Mines of Moderate Size."

Jackson—The Kennedy mine has been unwatered to a point 90 ft. below the 3,600 level. Drifts are being cleaned up and shaft repairs made. The Argonaut is practically unwatered. At both mines preparations to resume production are progressing.

On April 15 Mother Lode mining companies announced a wage cut of 50c. per shift. The principal reason given was that the living costs have declined a little over 20 per cent.

Plymouth—Superintendents of Mother Lode mines held their regular monthly meeting on April at the Plymouth mine. Those present were: W. J. Loring and S. L. Arnot, of the Plymouth Consolidated; W. P. Henry, A. S. Howe, and G. H. Kirsch, of the Central Eureka; Edwin Higgins and B. I. Hoxie, of the Fremont; James Spiers, of the Kennedy; O. D. Rohlfs, of the Amador Mines Co.; R. J. Christenson, of the Bunker Hill; O. McCrany and Byron E. Rowe, of the Belmont-Shawmut, and George J. Young, of the *Engineering and Mining Journal.*

Grass Valley—C. A. Brockington, of the Allison Ranch mine, is reported to have opened up promising ground in the south drift of the 600 level and to be drifting toward this area on the 800 level. The mine was reopened in 1917, but little encouragement up to date has resulted from prospecting work.

The North Star has discovered a good shoot of ore, and may be expected to increase its tonnage output. The Idaho-Maryland has unwatered its Canyon Shaft to below the 15th level.

Jenny Lind—Dredge superintendents of the gold dredging companies of California were the guests of F. J. Estep, of the Isabel Dredging Co., and F. P. Hanson, of the American Gold Dredging Co. recently. The operations of the dredges on the Mokelumne and Calaveras rivers were studied.

Randsburg—A 150-hp. hoist will be installed within the next sixty days at the Rand Divide mine.

The Swastika mine (Grady lease) is to install another 50-hp. compressor. The mine is now shipping five cars of ore weekly, an amount nearly equal to the output of the Rand Divide, and of the same character.

The Coyote mine, owned by Blanck & Kelley, will be ready for the installation of electrical power within thirty days.

The Yellow Aster mine recently made a test run, which, if up to expectations, will be followed by a resumption of operations. A lease for working tailings and dumps is reported to have been signed.

Trona—The Slate Range Minerals Co. suspended operations on March 31, owing to the slump in the lead market, and the increase in freight rates.

NEVADA

Placer Gold Discovered in Johnnie District

Johnnie—In the Johnnie district excitement has been caused by the discovery of placer gold. It was first found on the Climax group of Wedekind & Buol, coarse gold, ranging from wheat size to nuggets a half-inch in diameter. So far placer gravel has been found in five different places; also below the Congress group and on the Eureka-Johnnie. There is plenty of water for camp and domestic uses, but dry washers are to be used at the diggings. In the district are free gold veins and many paying quartz mines. The placers occur in clay-like washes, the loose gravel not carrying pay dirt. A syndicate of Tonopah business men has been formed to develop a number of claims and to prospect for the main channel.

MILLS OF YELLOW ASTER MINING & MILLING CO., RANDSBURG, CAL., WITH GLORY HOLE IN BACKGROUND

Pioche—Ore shipments for the week ended April 14 were nominal, Bristol shipping 465 tons and the Consolidated Nevada-Utah Currency lease 40 tons. Virginia Louise and Prince Consolidated are doing development work only. The Black Metals will not ship until the new rates are in effect.

Virginia City—The United Comstock Mines Co. will probably start construc-

tion of a 1,000-ton mill early in May for treating ore developed in its Gold Hill properties. Construction work on a two-mile spur track from the Virginia & Truckee R.R. will also be started soon. The adit being driven is making rapid progress.

At Silver City and Virginia City more than a dozen companies have been formed during the last few months for prospecting and developing areas in the vicinity.

The Consolidated Virginia milled 658 tons of $10.58 ore the week ended April 16. Development and stoping operations were carried on from the 1,650, 2,150 and 2,250 levels. The station on the 2,250 level of the C and C shaft has been reopened for pumping and mining convenience. On the 2,000 level of the Ophir the drift on the Hardy vein shows no improvement, being low grade as a whole.

ALABAMA

Alabama Company Drilling Near Attalla—Ore Production at Lowest Ebb, Independents Producing Nothing

Birmingham—The Alabama Company is drilling near Attalla, Etowah County, Ala. A 4-ft. vein of rich ore is reported to have been discovered at a lower depth than it had been thought good ore would be found. At the company's offices in Birmingham no announcement was obtainable. The report from Gadsden, near Attalla, is to the effect that forty years ago a mining engineer, whose opinion was law throughout the country, made a survey of the Gadsden district and declared that the veins being worked on Shinbone Ridge in Gadsden and in the mountains forming the western boundary of Attalla disappeared at a depth of about 300 ft. This was generally accepted as true until recently. It is said that a large sum has been spent in acquiring ore properties in this section. The deep mining project of the Gulf States Steel Co., at Shannon, is said to have exploded old theories as to the failure of veins at a certain depth below the surface.

It has been many years since iron ore production in the Birmingham district has been at a low ebb as at present. Independent ore companies have suspended all production. The three independent furnace companies that are running are the Sloss-Sheffield Steel & Iron Co., the Woodward Iron Co., and the Alabama Company, each of which has its own ore supply.

The Tennessee Coal, Iron & Railroad Co., the subsidiary of the U. S. Steel Corporation, has seven furnaces in blast, six on basic and foundry irons and one on ferromanganese. The last is using manganese ore from Brazil, and local ores are used in the six other furnaces. The company is mining ore to 60 per cent of its capacity. All furnace companies of the district have filled bins at furnace plants and have accumulated some ore at the mines so as to be prepared for a rush when the pig-iron market recovers.

MICHIGAN

Menominee Range

Chapin Mine Cuts Force—Iron County's Iron Land To Be Explored

Iron Mountain—The Chapin mine has has reduced its force by ninety men. The stocking space is about filled. This is the first Oliver mine on the Menominee Range to cut its operating force.

Iron Mountain—The West Chapin Mines Co. is negotiating for the purchase of a 100-ton blast furnace, which, if bought, will be moved to the property of the company near Iron Mountain. The Thomas Berry Chemical Co. has become interested in the West Chapin Mines Co., and will handle part of the products to be made at the chemical plant to be operated in connection with the furnace. The company has plenty of ore and of hardwood for charcoal, and it is thought that the manufacture of charcoal pig iron will be started before the close of the year. Several Lake Superior iron concerns are interested in the project.

Crystal Falls—All mining work has been suspended at the Hanna company's Carpenter mine. About 350 men are affected. The Carpenter had been a steady producer since first opened ten years ago. An automatic car dumper was recently installed underground in the property, and gave excellent results for the few days that it was in operation. This installation consists of two single-car pneumatic rotary car dumpers in tandem, each car dumper of a one-car capacity. The dumper was able to handle the ore as fast as brought to the shaft. A similar installation, augmented by an automatic skip-tripping device on the storage bin, will be added to the underground equipment at the Odgers mine.

Crystal Falls—The Palms-Book Land Co., owners of the fee of the Palms and Mikado mines, on the Gogebic Range, are to do extensive exploration work in Iron County, on the Menominee Range. A deal was recently entered into whereby this company has taken an option on lands owned by the Keweenaw Association, the Baldwin Corporation Co., the Menominee River Lumber Co., and the Prickett lands, in Iron County. The lands extend from Crystal Falls to Amasa, covering a strip several miles long, and the prospects of finding iron ore are considered promising. The work of exploring the lands will be in charge of Ralph S. Archibald, of Negaunee, Mich., representative of the Palms-Book Land Co. in the Lake Superior district.

Gogebic Range

Charcoal Iron Co. Cuts Wages Further at Yale Mine

Bessemer—The Charcoal Iron Co. is reported to have announced a second reduction in wages of 15 per cent at its Yale mine, at Bessemer. The first reduction was 20 per cent.

Ironwood—April 15 the Steel & Tube Co. began to operate its Newport and Anvil-Palms mines three days a week. These properties have been working on a four-day-a-week basis. This order will affect about 500 men at the Newport and 310 at the Anvil-Palms mine.

The Oliver Iron Mining Co. will begin laying track to serve "H" shaft, Pabst mine, in the immediate future. About 3,400 ft. of track will be required.

The Wakefield mine suspended operations indefinitely on April 16.

Marenisco—The Charcoal Iron Co. has leased its mill at Marenisco to the William Bonifax Lumber Co. after an idleness of almost four months. The mill is employing about 80 men, and indications are that the force will be increased to 100. It is planned to cut 8,000,000 ft. of logs at the rate of 50,000 ft. every twenty-four hours. Part of the timber is on hand at the mill and the remainder is ready for shipment.

MINNESOTA

Mesabi Range

Accident Floods Lincoln Mine at Virginia—Billings Closed Indefinitely

Hibbing—The Harold mine of the M. A. Hanna company has closed down temporarily. Over 100 men affected will be placed at the North Uno mine, which is to be reopened. Operations later will consist of underground work and some scramming in the pit for final clean-up in certain portions.

The stripping of the Pickands Mather Scranton pit, which is being done by the Winston Dear Co., is to be started soon. All buildings have been removed, and preparations made for handling a large yardage this season.

The first shipments from the stockpile of the Sargent mine, operated by the Wisconsin Steel Co., have gone to Duluth. Regular weekly shipments are anticipated.

Buhl—Stripping at M. A. Hanna Ore Ore Co.'s Wabegon pit is ready to start. A few minor changes were necessary on the No. 300 Marion dragline.

The Woodbridge stockpile, owned by the Fort Henry Mining Co., is being shipped steadily to Duluth.

Chisholm—The Billings mine, operated by the Tod Stambaugh Company, has closed indefinitely. Work of deepening the shaft was in progress when the closing order was received. It is rumored that the pumps are to be pulled. Fifty men are affected.

Virginia—The Lincoln mine, operated by the Interstate Iron Co., is flooded in many parts, owing to an accident. A 14-in. elbow on the discharge line from the pumps broke unexpectedly, and the pump house was flooded, putting all pumps out of commission.

Eveleth—The Oliver company's Fayal mine is shipping ore from its shaft to the D. M. & N. docks at Duluth. This is one of the first mines of the Oliver company to start shipping on the Mesabi Range. It is expected that the movement of ore from the company's large open pits will start in a short time.

THE MARKET REPORT

Daily Prices of Metals

April	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
21	12.25@12.50	29.50	31.00	4.25@4.30	4.25	4.80
22	12.25@12.50	29.50	31.00	4.25@4.30	4.25	4.85@4.90
23	12.25@12.50	30.00	31.50	4.25@4.35	4.25	4.90
25	12.35@12.50	30.50	32.25	4.25@4.40	4.25	4.95
26	12.35@12.50	30.25	32.00	4.25@4.50	4.25@4.35	4.95@5.00
27	12.35@12.50	30.00	31.50	4.35@4.50	4.35	5.00

*These prices correspond to the following quotations for copper, "delivered": 12.50@12.75c. for April 21 to 23; 12.60@12.75c., April 25 to 27.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
21	69⅛	69¾	71	168¾	171¼	21¼	21¾	26½	27¼
22	69⅞	70⅛	71	168¾	171½	21⅛	21⅛	26¼	27
23	...	...	...	.....	.....	...	...	..	...
25	70	70⅜	71	174	176¾	20¾	21¼	26	27
26	70¼	70½	72	173¾	176¼	20⅞	21⅜	26¼	26⅞
27	70	70⅛	72	172	174½	20⅞	21⅜	25¾	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

April	Sterling Exchange	Silver			Apr.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
21	392	99½	59¾	34½	25	394½	99¼	60⅜	34⅝
22	391⅞	99½	59⅞	34⅝	26	394	99¼	60⅜	34⅝
23	392½	99¼	60⅛	35	27	393¾	99¼	60¼	34⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, April 27, 1921

Inspired by an increasing demand from consumers and a prospect that the issue between the Allies and Germany may soon be settled, a distinctly better feeling has arisen in the copper, lead, zinc, and tin markets. Prices have also tended to higher figures, and it now seems unlikely that the low extremes of early 1920 will be repeated. Demand generally is for small tonnages for prompt delivery, but it is well distributed.

Copper

Sales in satisfactory volume have been made since our last report, at 12⅝@12.75c. delivered, and certain small tonnages of spot copper are reported at the 12.50c. level. Over the week-end, however, the sellers who were quoting this extremely low price dropped out of the market, and today one might have some difficulty in finding anything but small lots of spot metal at less than 12.75c. However, there has been some weakening on the part of large producers, and although some continue to quote 13c., and are standing by that price, others are meeting the market. Large tonnages of May-June copper could be obtained at 12.75c. Practically no business is being done in copper for delivery later than this, but a premium would be asked for such forward contracts.

Demand has been well distributed, though wire and cable manufacturers have been the principal buyers. The brass mills continue to be well supplied by Government stocks of scrap, so are not interested in much new metal. Foreign buying has not been large, but it is generally conceded that it only awaits a settlement of the reparations question. Japanese copper production is reported to be greatly curtailed, it being more economical for Japan to buy copper on the Pacific Coast than to produce it.

Lead

On Tuesday, April 26, the American Smelting & Refining Co. increased its official contract price of lead from 4.25c. to 4.35c., New York and St. Louis.

Lead has been distinctly stronger and in increasing demand at the prices quoted by the A. S. & R., which are lower than the metal could be obtained for in the outside market. It is altogether likely that the market will continue to become firmer, as this interest is hardly capable of supplying so large a demand as now exists. The comparatively low prices quoted are no doubt influenced by the activity of the Penarroya agents in New York, who are trying to interest large consumers in lead for shipment from Spain at approximately current London prices. We have not heard that their efforts are meeting much success. The demand for forward metal is small, but American producers are asking a premium. Practically all the lead which has been sold is for prompt or May shipment, and June metal could not be obtained at any time during the last week for less than 4.50c. Chemical lead is quoted at 4 35@4.50c., St. Louis.

Zinc

The improvement noted last week has continued, and today it is difficult to obtain Prime Western zinc under 5c., East St. Louis. A steady demand from galvanizers, who have taken all the metal offered, mainly accounts for the rise of 40 points in the last two weeks. Large tonnages for these times were sold at the prices recorded during the week, and the market still has a firm undertone. Although zinc production is exceptionally low, it was the influence of demand rather than supply which led to the improvement. Many smaller zinc producers are not in a sufficiently strong position financially to accumulate stocks, and as a result their necessity of disposing of their metal regardless of the market has frequently prevented the price from rising. Little interest is manifested in futures, but a premium would be asked. Electrolytic and high-grade zinc was sold during the week for 6.50@6.75c. in somewhat larger tonnages than usual.

Tin

The week-end advance in London resulted in better prices here, naturally, but the interest was largely confined to dealers. Apparently consumers do not yet find their business sufficiently improved to order in any quantity. The demand has been better for 99 per cent grades than for Straits. A fair tonnage of electrolytic has been sold at prices equal to Straits and down to as much as one-half cent below. Futures are quoted at the same prices as for spot, but for deliveries as late as August a premium of at least a quarter of a cent would be asked.

Arrivals of tin in long tons: April 21st, London, 50; Straits, 20; 23d, London, 25; 25th, Liverpool, 100; 26th, Straits, 100.

Gold

Gold in London: April 21st, 104s. 8d.; 22d, 104s. 10d.; 25th, 104s. 3d.; 26th, 104s. 2d; 27th, 104s. 2d.

Foreign Exchange

On the improved outlook for a settlement of the reparations problem, francs have gained nearly half a cent over a week ago. Sterling has continued firm. On Tuesday, April 26, francs were 7.6825c.; lire, 4.90c; and marks, 1.58c. New York funds in Montreal, 11$\frac{3}{32}$ per cent premium.

Silver

The silver market in London has ruled fairly steady in the last week at 34$\frac{5}{8}$d., with the exception of a slight spurt on April 23 to 35d., on speculative demand. The New York quotation has closely followed the London price, with some improvement, due to higher rates for sterling exchange. The market continues dull, with moderate offerings of silver on the one hand and a limited demand on the other. Basic commercial conditions in China and India are unfavorable for an immediate advance in the price of silver, and the market is likely to rule around present levels unless some speculative demand causes an advance.

The price of domestic silver is now 99½c. instead of 99½c. This is because of the fact that coinage of silver dollars has been begun at the Denver mint and all silver must be delivered at that point. This adds about ½c. to the cost of delivery under the former conditions.

Mexican Dollars — April 21st, 45$\frac{5}{8}$; 22d, 45$\frac{7}{8}$; 23d, 46$\frac{1}{8}$; 25th, 46$\frac{1}{8}$; 26th, 46$\frac{1}{8}$; 27th, 46$\frac{1}{8}$.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5½c.; market dull. W.C.C. brand, 5¾@6c. per lb. Cookson's "C" grade, spot, 9$\frac{5}{8}$c. Chinese needle antimony, lump, nominal at 4½c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.60 per lb., 500-lb. lots.

Cadmium—Nominal, $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $4 per lb.; black oxide, $3@$3.10 per lb. in bbls.; sulphate, $1.35 per lb. in bbls.

Iridium—Nominal, $250@$300 per oz.

[1]Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $46@$48 per 75-lb. flask. San Francisco wires $48.50.

[1]Rhodium—$200@$225 per troy oz.

Ruthenium—$175@$200 per troy oz.

[1]Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 45@50c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $7.45; Mesabi bessemer, 55 per cent iron, $7.20; Old Range non-bessemer, 51½ per cent iron, $6.70; Mesabi non-bessemer, 51½ per cent iron, $6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore—30c. per unit, seaport; chemical ore (MnO_2) $60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1.50 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York.

[1]Zircon—Washed, iron free, 3c. per lb.

[1]Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., April 23.—Zinc blende, per ton, high, $25.10; basis 60 per cent zinc, premium and Prime Western, $25; fines and slimes, $22.50@20; average settling price, all grades of zinc, $22.61.

Lead, high, $48.40; basis 80 per cent lead, $47.50@$50; average settling price, all grades of lead, $47.23 per ton.

Shipments for the week: Blende, 4,993; lead, 963 tons. Value, all ores the week, $158,380.

Platteville, Wis., April 23.—A base price of $27.50 was offered for 60 per cent zinc ore this week, but operators refused to sell at this price. Shipments for the week: Blende, 84 tons. Shipments for the year: Blende, 11,295; lead ore, 550 tons. Shipped during the week to separating plants, 421 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $2,000@$3,000; No. 2, $1,400@$2,000; spinning fibres, $400@$1,000; magnesia and compressed sheet fibres, $325@$500; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats $8.50@$15, all per short ton, f.o.b Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, car load lots; (off-color) $22@$26 in bags carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7 per long ton, f.o.b. Cartersville, Ga. Small lots as low as $5.

Bauxite—High-grade French bauxite, $8@$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, $16.50 per ton; ground, $22; calcined, ground $35; unground, $45, f.o.b. plant.

Chalk—English, extra light, 5@5½c. Domestic light, 4½@5c.; heavy, 4@4½c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $8@$10; washed, $10@$12; powdered, $15@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $15@$20, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $15@$25, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c. f.o.b. New England points.

Feldspar—Crude, $8@$14 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $32, New Mexico, Canadian price generally $18 (Canadian currency) per ton, f.o.b. mines. Market is improving in western ground acid grades for glass and enamel manufacture.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7½@8c. per lb.; chip, 6@6½c.; dust, 4@4½c. No. 1 flake, 7c.; amorphous crude, ¾c.@2¼c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$2 per net ton; 1½ in., $1.50@$2. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $38 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $55@$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $7.35; 68 per cent, $6.85; 68@66 per cent, $6.60.

[1]Foote Mineral Co., Philadelphia, Pa.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17; all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported generally dull.

Sulphur—$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $18@$40, talcum powder grade. Southern talc, powdered, carload lots, $10@$14 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 8@9c. per lb. in carload lots.

Sodium Nitrate — $2.75@$2.85 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.75@$1.80 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $85@$90, f.o.b. furnace; resale, $90, delivered; English, $90@$95, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $50@$55; 50 per cent, $80@$85; 75 per cent, $145@$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 15c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 7¾c. in quantity, mill lots.

Nickel Silver — 33½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets 18¼c.; sheathing, 17¼c.; rods, ⅜ to 3 in., 15¼c.

Zinc Sheets—$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $45@$50 per net ton, and $55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $75 per net ton, shipping point; arches, keys, wedges, $80; splits, soaps, $90.

Fire Brick—First quality, 9-in. shapes, $40@$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $40@$50.

Magnesite Brick—9-in. straights, $90@$95 per net ton; 9-in. arches, wedges and keys, $100; soaps and splits, $110.

Silica Brick—9-in., per 1,000: $45@$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, April 26, 1921.—Steel prices as recently equalized between the Steel Corporation and independents are holding without difficulty.

Standard, small and boat spikes are again quoted at a single base price, 3.40c., as was the practice before the war, the extras for small sizes being those of the war control, slightly greater than in the old list. Chain has been reduced again, from 6.75c. to 6.25c., base, and extras on sizes under ½-in. are lessened by 25c. Cold-finished steel bars are now uniformly quoted at 3.10c., base, against cut prices recently ruling of 2.90c. to 3c. Consumption of steel is unchanged.

Pig Iron—The report that a sale of 5,000 tons of basic has been made at $22.50 is both denied and reaffirmed. Foundry is offered at 50c. under former quotations by one producer. The market is quiet. We quote: Bessemer, $25; basic, $23; foundry, $24.50@$25, f.o.b. Valley furnaces, with $1.96 freight to Pittsburgh.

Coke

Connellsville—Furnace, $3.50@$4.25; foundry, $4.50@$5.50.

Record Gold Tribute

Imports of the Metal From All Over the World Into the United States May Break Record of 1917 and Have Reversed the Tide of 1920—Effect on Domestic Industry Problematical—Present Gold Production Is Insignificant Compared With Imports

EDITORIAL MARKET STUDY

A YEAR AGO exports of gold from the United States impelled many bankers and economists to question the effect of these movements on the financial structure of the country. One large bank in New York seriously proposed the consideration of an embargo on gold, so as to prevent undue disturbance and contraction of the credit of the country. A reverse movement is now taking place; gold has been pouring into our coffers to the amount of about $280,000,000 net during the last six months, and the gold holdings of the United States are approaching closely the record set in 1917. Should the present movement continue, this record may be surpassed and a figure established such as was never attained by any single country's gold accumulation in all history.

What will be the effect of this tribute of the precious metal from so many countries? Some bankers maintain it will inflate prices here, and hence are skeptic as to its effects and advisability. One beneficial effect has been and will be the betterment of exchanges in those countries exporting the gold. In general, most of the nations of the world can ill afford to release their gold holdings and must resort to other methods in settling their adverse trade balances, i.e., selling goods or services, which is the only way they can ultimately discharge their heavy obligations.

Credit Inflation or Reserve Strengthening?

The stupendous economic disturbances of the last seven years have set in motion great tides beyond the control of any one nation. Fortunately, most of the unusual economic conditions arising out of these disturbances have a way of becoming settled without any extraneous assistance. So it will probably be with the present inward gold movement as it was with last year's outward movement. The added gold supplies may increase prices of commodities in the United States, in which event, theoretically, our export trade should diminish and imports should increase, resulting in subsequent exportations of gold to pay for them. Regardless of the theoretical considerations involved in the results, and viewed from an international standpoint, it is regrettable that large shipments of gold are being added to our already abnormally great stock of the metal. However, there seems to be no immediate way out of the difficulty. European nations cannot be blamed for wishing to restore their currencies to a gold basis, and one of the easiest and quickest methods is by means of gold payments.

According to a statement issued by a leading New York bank, a gold dollar in the vaults of a Federal Reserve Bank serves or may serve as the basis of deposit liabilities of $2.50 (40 per cent gold reserve behind notes) and these deposits to the credit of a member bank may in turn serve to enable credit extension by that bank of anywhere from seven and one-half to fourteen times that amount, or, say, $19 to $35. Hence the alarm over another period of credit expansion. A wide difference of opinion exists, however, as to whether this would be the effect of the present gold movement, other financiers maintaining that any additional supply of gold would tend only to strengthen reserves. The results would appear in large measure to follow the banking policy of the country.

Last Year's Gold Loss Regained

On April 1, 1921, gold stocks were reported by the Treasury as amounting to $3,001,488,000. The record held by the United States was $3,121,887,440 reported May 1, 1917, so that it is not unlikely that the record will be broken by the present movement. The low point in gold holdings occurred exactly three years later, following the long drain of gold after the embargo was lifted (June 1, 1919), and stocks then, May 1, 1920, totaled $2,646,615,750, a drop of over $475,000,000. This loss has been almost wiped out by the accumulation of the last eleven months.

The heaviest shipments of gold are being made from France, England, and the Scandinavian countries. Total comparative imports and exports of gold to and from the United States for the first three months of 1920 and 1921, as given in the following table, show how completely the gold tide has reversed:

	Exports		Imports	
	1920	1921	1920	1921
January	$47,816,900	$2,725,000	$12,017,500	$38,193,700
February	42,873,400	1,036,000	4,473,400	44,422,400
March	47,049,200	700,000	16,985,200	106,000,000

Although large amounts of gold have come from England, this metal is mainly the product of British mines and is sold in an open market. As an embargo is still in effect on the export of gold from England, it is impossible for bankers who negotiate gold shipments to procure the metal from the Bank of England. However, newly mined gold, South African in particular, is freely sold in the London market and is an exception to the rule. Active competitive bidding may come from India, the United States, or local British financial interests. Of late American bankers have had the field for themselves. The price paid for the gold depends upon the depreciation of the pound sterling, and at present is about 104s., compared with a normal price of about 85s.

Imported Gold Being Carefully Scrutinized

Some of the gold being sent to the United States is reported to be of Russian origin, shipped through neutral countries. Precautions are being taken by the United States Government to prevent any Russian gold being taken by the banks. The prejudice is due to the irresponsible character of an unrecognized government, whose present acts may be subject to later denunciation by a more representative administration and a claim, coupled with legal entanglements, that the Soviet regime has virtually looted the Russian treasury in selling its gold. The attitude of the various governments which are refusing to accept this gold is prompted more by solicitude for the Russian people than by any desire to harm them financially. No doubt the reports that have been circulated about the size of these shipments have been exaggerated.

Circulation of Gold Discouraged

Despite the fact that more than one-third of the world's gold stock is now in the United States, the circulation of gold is still discouraged, due to the great amount of paper money that rests upon the gold reserves.

Japan is another country having an abnormally large stock of gold, and the stagnation of business in Japan is attributed largely to the locally high prices of commodities, as a result of the heavy gold supply.

In view of the great stocks of gold in the United States and the constant additions, the effort of American producers to do their share in adding to the gold reserve seems puny. Almost twice as much gold was imported during the month of March as was produced in the United States during the whole of 1920.

COMPANY REPORTS

Butte & Superior Shows Net Decrease

Zinc; Montana

A report of operations of Butte & Superior Mining Co. for 1920 states that 87,259,471 lb. of zinc, 7,198,086 lb. of lead, 727,113 lb. of copper, 1,617,877 oz. of silver, and 2,853 oz. of gold were contained in zinc and lead concentrates produced. Income account follows:

	Year 1920	Year 1919
Revenue:		
Zinc and lead concentrates and residues	$4,460,547.20	$5,912,640.11
Less freight	681,270.77	1,051,470.59
	$3,779,276.43	$4,861,169.52
Costs and expenses:		
Mining	$2,260,486.52	$2,542,758.12
Milling—334,919 tons	1,020,044.76	1,106,795.58
Other charges, shutdown expenses, depreciation, etc	401,487.50	295,343.49
Total operating costs and expenses	$3,682 018.78	$3,944,897.19
Net income from operations plus depletion	$ 97,257.65	$ 916,272 33
Other income	$ 98,432.80	$ 126,266.40
Total income from all sources	$ 195,690.45	$1,042,538.73
Reserve for taxes, contingencies, etc.	7,761.75	177,549.00
Net income and proceeds of depletion —to surplus account	$ 187,928.70	$ 864,989.73
Surplus from operations:		
Balance as stated Dec. 31, 1919		$3,062,120.81
Net income and proceeds of depletion—as above		187,928.70
Balance of surplus—Dec. 31, 1920		$3,250,049.51

Net current assets Dec. 31, 1919, were $2,808,966.16; on Dec. 31, 1920, $2,722,209.17.

New Cornelia Surplus Increases

Copper; Arizona

A report of operations of the New Cornelia Copper Co. for 1920 shows that 40,104,493 lb. of copper was produced, and 34,146,769 lb. delivered at an average price of 18.56c. per lb. Two dividends, totaling $900,000, were paid. A statement of income and expenditure follows:

EXPENDITURES	
Operating expenses	$3,220,422.31
Salaries, office, general expenses	43,760.04
Freight, refining, marketing	671,548.99
State and Federal taxes	594,939.22
	$4,530,670.56
Depreciation charges	692,582.68
Ore depletion charges	921,028.75
Interest	19,918.68
	$1,633,530.11
Net income	991,136.58
	$7,155,337.25
INCOME	
Total earnings on metals	$7,089,512.99
Dividends	5,100.00
Other income	60,724.26
Total	$7,155,337.25

Earned surplus on Dec. 31, 1919, amounted to $2,857,463.46; on Dec. 31, 1920, $2,948,600.04. Copper on hand valued at 12½c. per lb. amounted to $4,589,691.75.

Silver King Levies Assessment

Lead; Utah

A report of operations of the Silver King Consolidated Mining Co. for 1920 states that 234,509 lb. of lead, 12,771 oz. of silver, and some other metals were produced, to the value of $26,305. Receipts totaled $253,876, and include the items "convertible notes," $152,600; "bills payable," $4,100, and balance on hand Jan. 1, 1920, $32,987. Disbursements also totaled $253,876. Capital stock outstanding Dec. 31, 1920, amounted to 850,537½ shares, $1 par. Owing to the high cost of development operations, an assessment of 10c. per share was levied on April 6, 1921.

Old Dominion 1920 Operations Unprofitable

The annual report of the Old Dominion Co. for 1920 states that 22,854,452 lb. of copper, 181,010 oz. silver, and 3,484 oz. gold was produced, and 28,818,025 lb. of copper was sold and delivered at 18.374c. per lb. Income account follows:

Income:		
Sales of copper, silver, and gold		$5,548,177.28
Expenses:		
Finished metals on hand at beginning of the year	$4,214,775.34	
Mining, treating, and refining	4,045,866.09	
	$8,260,641.43	
Finished metals on hand at end of the year	3,169,579.12	
	$5,091,062.31	
Selling, general, and administrative expenses	127,657.03	
Depreciation of plant and equipment	138,947.68	
Depletion of mines	333,340.92	
Interest	165,334.53	5,856,342.47
Loss for the year 1920		$308,165.19

Surplus balance on Dec. 31, 1919, amounted to $3,364,667.22; on Dec. 31, 1920, $3,056,502.03. No dividends were paid during the year.

Yukon Gold Deficit $393,223

A report of operations of the Yukon Gold Co. for 1920 states that the company's tin deposits in the Federated Malay States are undergoing development. A statement of the income derived from other operations follows:

	Cubic Yards	Production	Working Costs	Operating Gain
Dawson dredges	1,226,578	$415,030	$319,997	$95,033
Dawson hydraulics	1,702,264	284,969	160,837	124,131
California dredges	4,900,726	494,490	358,123	136,367
Murray dredge	1,295,900	96,332	83,248	13,084
Miscellaneous operations	.....	34,216	1,244	32,972
Total operations	.....	$1,325,037	$923,449	$401,588
Non-operating income				$109,491
Total income				$511,079
Less:				
Royalties paid			$15,603	
Interest charges, general expense and examinations			191,089	206,692
Net operating income				$304,387
Less:				
Depletion			$206,900	
Depreciation			373,923	
Advance to subsidiary companies—Written off			116,787	697,610
Net deficit for year 1920			.....	$393,223

Tonopah Belmont Net Profits Increase

Silver; Nevada

The annual report of operations of the Tonopah Belmont Development Co. shows that two dividends were paid during 1920, of $75,000 each, or 5 per cent on the $1,500,000 shares of $1 par value fully issued. Operating statement:

	Year Ended Dec. 31, 1020	Year Ended Dec. 31, 1919
Gross value of production	$1,796,141.51	$1,231,482.59
Losses in treatment	141,338.28	106,625.85
Net values realized	$1,654,803.23	$1,124,856.74
Operating expenses	1,252,395.55	742,860.93
Net earnings mine and Tonopah mill	$402,407.68	$381,995.81
Net earnings of other plants	55,418.81	28,103.84
Total net earnings from operation	$457,826.49	$410,099.65
Other income	(a)204,531.74	(a)204,351.94
Gross income	$662,358.23	$614.451.59
Administration, exploration, taxes, etc	59 211.51	44,644.94
Net profit	$603,146.72	$569,806.65

(a) Includes dividends from Belmont Surf Inlet Mines, Ltd.

The Belmont Surf Inlet Mines, a subsidiary company, shows $866,929.46 in values realized, and a net income of $212,103.45, from which $16,844.50 has been deducted as a reserve for income taxes.

MINING STOCKS

Week Ended April 23, 1921

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Adventure	Boston	....	....	*60		
Ahmeek	Boston	....	....	49	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	1/8	1/16	1/8		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	39⅜	37⅜	39⅛	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3	2⅞	2⅞		
Ariz. Com'l	Boston	8⅜	8¼	8⅜	Oct. '18,	.50
Big Ledge	N. Y. Curb	1/16	¼	1/16		
Bingham Mines	Boston	....	....	8¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	50	48	49½	Mar. '21, Q	.50
Calumet & Hecla	Boston	238	226	237	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*13		
Centennial	Boston	....	....	8	Dec. '18, SA	1.00
Cerro de Pasco	New York	28⅜	27½	28½	Mar. '21, Q	.50
Chile Copper	New York	11⅛	11⅛	11⅛		
Chino	New York	24	22⅞	24	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	‡....	....	*24½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb			1⅛		
Copper Range	Boston	35½	34⅛	35	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*30	*28	*28		
Davis-Daly	Boston	6½	6½	6½	Mar. '20, Q	.25
East Butte	Boston	9⅛	8½	9⅛	Dec. '19, A	.50
First National	Boston Curb	*85	*65	*85	Feb. '19, SA	.15
Franklin	Boston	2	2	2		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	....	....	20½	May '19, Q	1.25
Greene-Cananea	New York	24⅛	24	24	Nov. '20, Q	.50
Hancock	Boston	....	....	2½		
Howe Sound	N. Y. Curb	....	....	2½	Jan. '21, Q	.05
Inspiration Consol.	New York	35	33⅛	35	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6	6	6	Sept. '20, K	.25
Isle Royale	Boston	20⅛	19	20	Sept. '19, SA	.50
Kennecott	New York	20⅛	19⅛	20⅛	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1⅜		
Lake Copper	Boston	2⅛	2⅛	2⅛		
La Salle	Boston	1⅛	1⅛	1⅛		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	22	19½	22	Jan. '19, Q	.50
Majestic	Boston Curb	*9	*9	*9		
Mason Valley	Boston	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	2⅜	2	2⅛	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	3⅞	4		
Miami Copper	New York	22⅛	20⅜	22⅛	Feb. '21, Q	.50
Michigan	Boston	....	....	3		
Mohawk	Boston	50	49	49⅜	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	4⅛	4⅛	4⅛		
Nevada Consol.	New York	12	11⅛	12	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	15⅛	13⅜	15⅛	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	11⅛	10⅜	11	Oct. '18, Q	.25
North Lake	Boston	⅜	⅜	⅜		
Ohio Copper	N. Y. Curb	....	....	1/16		
Old Dominion	Boston	20	18½	20	Dec. '18, Q	1.00
Osceola	Boston	27	26	27	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†135	....	Apr. '21, Q	1.00
Quincy	Boston	39½	38⅛	39⅛	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅜	12⅜	13⅛	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*35		
St. Mary's Min. Ld.	Boston	39	36½	38	June '20, K	2.00
Seneca Copper	Boston	15⅜	15⅛	15⅜		
Shannon	Boston	*90	*80	*80	Nov. '17, Q	.25
Shattuck Arizona	New York	6	5⅜	6	Jan. '20, Q	.25
South Lake	Boston	....	....	1½		
Superior Copper	Boston	....	....	3	Apr. '17,	1.00
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs	New York	9⅛	8⅛	9⅛	May '18, I	1.00
Toulumne	Boston	*48	*43	*47	May '13,	.10
United Verde Ex.	Boston Curb	29	25½	26½	Feb. '21, Q	.50
Utah Consol.	Boston	4	3⅜	3⅜	Sept. '18,	.25
Utah Copper	New York	54	50	54	Mar. '21, Q	1.00
Utah M. & T.	Boston	1⅜	1⅛	1⅜	Dec. '17,	.30
Victoria	Boston	1	0.70	0.90		
Winona	Boston	*46	*45	*46		
Wolverine	Boston	12	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	15⅜	14⅛	15⅜	Mar. '19,	.50
Internat. Nickel, pf.	New York	...	...	80	Feb. '21, Q	1.50
LEAD						
National Lead	New York	75½	71½	75½	Mar. '21, Q	1.50
National Lead, pfd.	New York	105½	105	105½	Mar. '21, Q	1.75
St. Joseph Lead	New York	11⅜	11⅛	11⅜	Mar. '21, Q	.25
Stewart Mining	Boston Curb	....	....	*6	Dec. '15,	.05
ZINC						
Am. Z. L. & S.	New York	9⅛	8⅛	9⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	28⅛	28	28	Nov. '20, Q	1.50
Butte C. & Z.	New York	5	4⅜	4⅜	June '18,	.50
Butte & Superior	New York	12⅛	11⅜	12⅛	Sept. '20,	1.25
Callahan Zn-Ld.	New York	5⅛	4⅛	5	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	125	115	120	Feb. '21, Q	2.00
Success	N. Y. Curb	*3⅛	*2	*3	July '16,	.03
Yellow Pine	Los Angeles	....	....	1⅛	Sept. '20, Q	.03

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	1⅛	⅜	1		
Alaska Juneau	New York	1⅜	1⅛	1⅛		
Carson Hill	N. Y. Curb.	....	....	22⅛		
Cresson Consol. G.	N. Y. Curb	1⅛	1 1/16	1 1/16	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*60⅛		
Dome Mines	New York	21⅛	19⅛	19⅛	Apr. '21, Q	.25
Golden Cycle	Colo. Sprgs.	*74	*68	*74	Dec. '20, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*5	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.40	7.00	7.40	Feb. '21, M	.05
Homestake Mining	New York	58⅜	58	58	Sept. '19,	.50
Kirkland Lake	Toronto	*55	*50	*54		
Lake Shore	Toronto	1.36	1.16	1.36	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	2.14	1.94	2.12	Jan. '21, K	.05
Porcupine Crown	Toronto	*25	*21	*24½	July '17,	.03
Portland	Colo. Sprgs.	*50	*48	*50	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*5	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*6	*3	*5		
Teck Hughes	Toronto	*18	*12	*16½		
Tom Reed	Los Angeles	1.12	0.99	1.00	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅛	2⅛	2⅛	Apr. '21, Q	.15
Vindicator Consol.	Colo. Sprgs.	*30	*20	*30	Jan. '20 Q	.01
West Dome Consol.	Toronto	*8	*7¼	*8		
White Caps Mining	N. Y. Curb	*8	*6½	*7		
Yukon Gold	Boston Curb	*73	*70	*70	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*34	*28	*29	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*36	*32½	*34½	May '20, K	.03
Coniagas	Toronto	1.90	1.75	1.75	Nov. '20, Q	.12½
Crown Reserve	Toronto	*12	*12	*12	Jan. '17,	.05
Kerr Lake	Boston	3	2⅞	2⅞	Apr. '21, Q	.12½
La Rose	Toronto	*23½	*23	*23	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	....	....	0.95	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7	6	6⅛	Apr. '21, Q	.15
Ontario Silver	New York	4⅛	4⅛	4⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	1⅞	1⅛	1⅛	Jan. '12,	.10
Peterson Lake	Toronto	*6	*6	*6	Jan. '17,	.01½
Temiskaming	Toronto	*24½	22	*23	Jan. '20, K	.04
Trethewey	Toronto	*13¾	*12	*13	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*1	*1/16	*1		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*65	*60	*61		
Cashboy	N. Y. Curb	*6	*4	*4½		
El Salvador	N. Y. Curb	....	....	⅛		
Jim Butler	N. Y. Curb	*9	*7	*8½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*7	*5	*6	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M. & M.	N. Y. Curb	*14	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	1⅛	1 1/16		
Tonopah-Extension	N. Y. Curb	1⅛	1⅛	1 1/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1 1/16	1/16	1 1/16	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N.Y. Curb	*11	*9	*10	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡....	....	1.05	Dec. '20,	.15
Chief Consolidated	Boston Curb	2⅛	2⅛	2⅛	Feb. '21, Q	.05
Consol. M. & S.	Montreal	15½	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡....	....	2.50	July '20, Q	.10
Daly-West	Boston	2⅛	2⅛	2⅛	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2⅛	Apr. '21, K	.05
Electric Point	Spokane	*7⅛	*7	*7	May '20, SA	.03
Federal M. & S.	New York	7	7	7	Jan. '09,	1.50
Federal M. & S., pfd.	New York	23⅛	23⅛	23⅛	Mar. '21, Q	1.00
Florence Silver	Spokane	*16	*16	*16	Apr. '19,	.01½
Grand Central	Salt Lake	‡....	....	*37½	June '20, K	.03
Hecla Mining	N. Y. Curb	3⅛	3⅛	3⅛	Mar. '21, Q	.15
Iron Blossom	N. Y. Curb	*15	*15	*15	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡....	....	3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*6⅛	*5	*6⅛		
Prince Consol.	N. Y. Curb	1/16	⅛	1/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*5	*4	*5	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*7⅛	*7⅛	*7⅛		
South Hecla	Salt Lake	‡....	....	*91	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	1/16	1/16	1/16	Oct. '17,	.05
Tamarack-Custer	Spokane	1.90	1.90	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	‡....	....	2.60	June '20, Q	.10
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*4	*3	*4	Nov. '17,	.01
QUICKSILVER						
New Idria	Boston	....	....	*95	Jan. '19,	.25
VANADIUM						
Vanadium Corp.	New York	30¾	28⅛	30¾	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	71¾	57½	60	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	....	....	89½	Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	40⅜	39½	40⅜	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	77⅛	76⅛	77⅛	Mar. '21, Q	1.75
Am. Sm. pf. A	New York	65⅜	65⅛	65⅜	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	32	30	32	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston	41½	40⅜	40⅜	Apr. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.